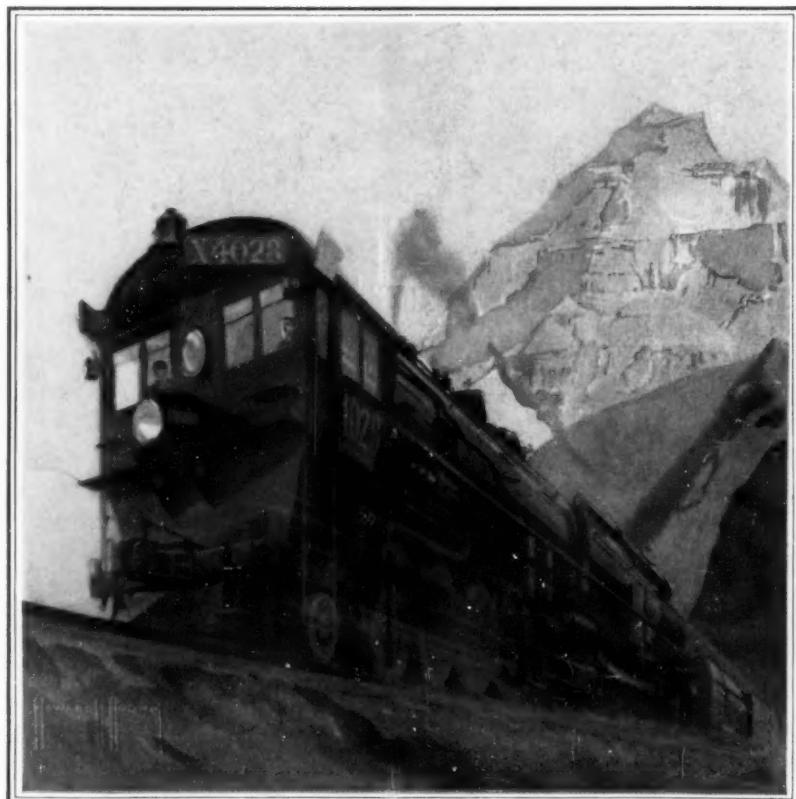


# SCIENTIFIC AMERICAN

October 1928

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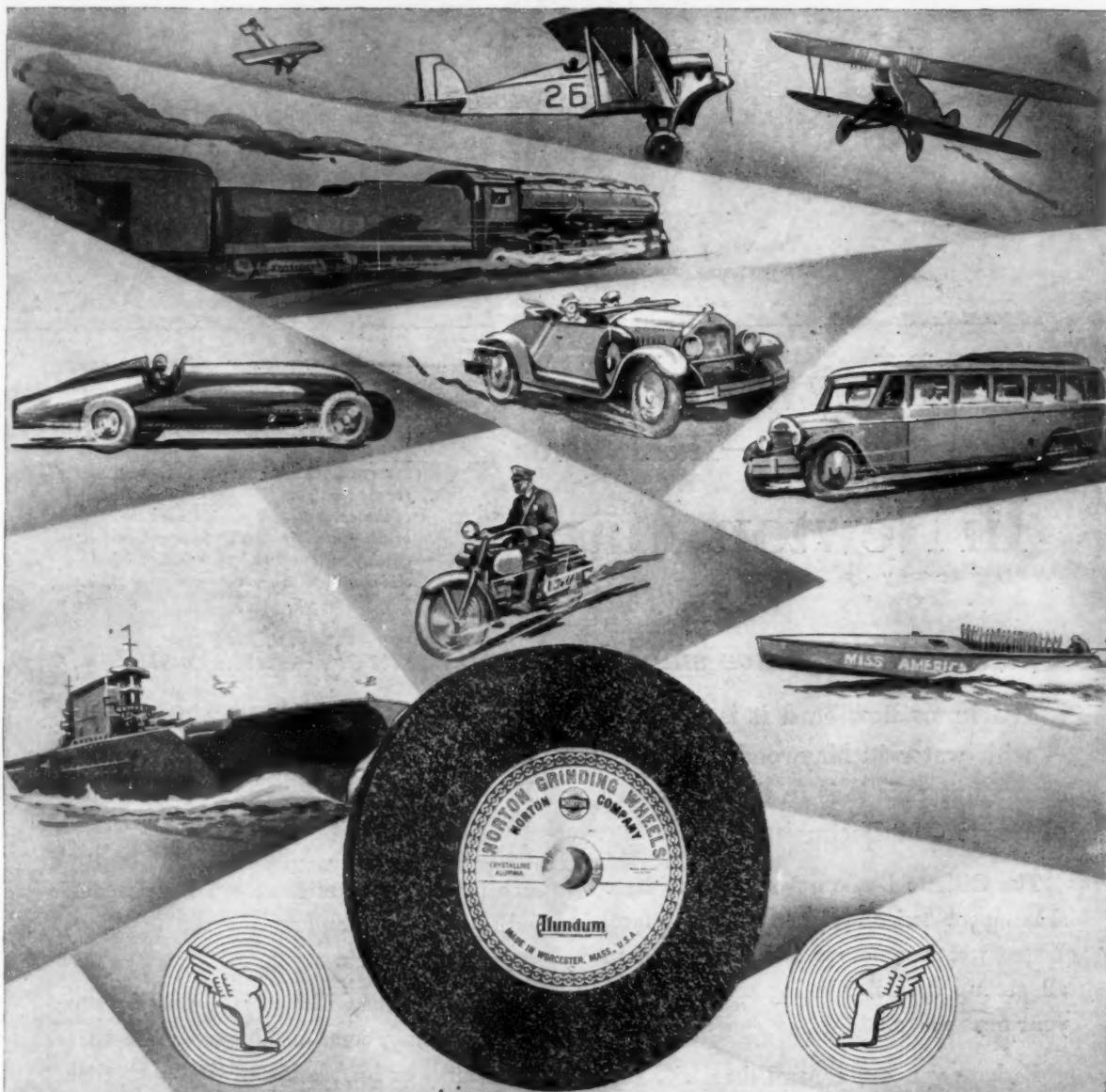
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# SCIENTIFIC AMERICAN

24 WEST 40th STREET

NEW YORK CITY

October 1928

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Eighty-fourth Year

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### COVER

The Southern Pacific Railroad decided to re-build seven Mallet type locomotives to facilitate freight movement through the Rockies. Our cover this month shows the first of these rebuilt locomotives to be finished, "with the hind part before," as described on page 350.



# Timken Steel for Timken Bearings

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MAKE	MODEL	Front Wheel	Rear Wheel	Pinion	Steering Pivots	Differ- ential
Auburn	All	x	x	x	x	x
Cadillac	All	x	x	x	x	x
Chandler	65	x	x	x	x	x
Chrysler	Big 68 Royal De Soto Plymouth 63 & 75	x	x	x	x	x
Cunningham	All	x	x	x	x	x
Dodge	All	x	x	x	x	x
Durant	4-M and 53 65 & 75	x	x	x	x	x
Elcar	6-70 8-75, 8-82 8-91, 8-92	x	x	x	x	x
Falcon	All	x	x	x	x	x
Ford	All	x	x	x	x	x
Franklin	All	x	x	x	x	x
Gardner	All	x	x	x	x	x
Graham-Paige	614 619, 629, 835	x	x	x	x	x
Hudson and Essex	All	x	x	x	x	x
Hupmobile	Century 6 Century 125 Century 8	x	x	x	x	x
Jordan	All	x	x	x	x	x
Kissel	All	x	x	x	x	x

MAKE	MODEL	Front Wheel	Rear Wheel	Pinion	Steering Pivots	Differ- ential
Kleiber		x	x	x	x	x
LaSalle	All	x	x	x	x	x
Lincoln	All	x	x	x	x	x
Locomobile	8-70	x	x	x	x	x
Marmont	{ 78	x	x	x	x	x
McFarlan	All	x	x	x	x	x
Moen	All	x	x	x	x	x
Nash	Std 6	x	x	x	x	x
Peerless	All	x	x	x	x	x
Pierce-Arrow	6-91, 6-60 and 6-80	x	x	x	x	x
Pierce-Arrow	81 36	x	x	x	x	x
Reo	FlyingCloud Wolverine	x	x	x	x	x
Roamer		x	x	x	x	x
Stearns-Knight	All	x	x	x	x	x
Studebaker	All	x	x	x	x	x
Erskine	All	x	x	x	x	x
Stutz	All	x	x	x	x	x
Velie	All	x	x	x	x	x
Willys-	Whippet 4	x	x	x	x	x
Overland	Whippet 6 66-A 70-A	x	x	x	x	x

# TIMKEN *Tapered* *Roller* BEARINGS

Scientific American, October, 1928, Vol. 139, No. 4, entered at the New York, N. Y., Post Office as Second Class Matter June 28th, 1879, under the Act of March 3rd, 1879; additional entry at Dumellen, N. J. Published Monthly by Scientific American Publishing Co., 24 West 40th Street, New York City. Copyright 1928 by Scientific American Publishing Co., Great Britain Rights Reserved. Subscription Price \$4.00 per year.

# Looking Ahead With the Editor

## Just Sitting or Standing

WHEN you sit, do you just sit? When you stand, do you just stand? Do you ever consider your posture? Why not? Working efficiency and health are vitally dependent upon the way in which you hold your body when sitting or standing. If either your posture or carriage is incorrect, you want to know about it, don't you? Then read what a psychologist who has studied posture has to say in a future issue.

## Man's Greatest Mechanical Invention

OFFHAND, what would you say it is? It is not modern by any means, for it dates back some 5000 years. It is the wheel. Wheels compose a part of practically every vehicle used by man today and there is scarcely any kind of machinery that does not use them. Thus it can be seen that there is much romance behind them. A scholarly study of their mechanics, with other information about them, is coming soon.

## Paleolithic Man in Ireland

M R. J. REID MOIR, well-known to SCIENTIFIC AMERICAN readers, tells in a forthcoming article of the discovery of artifacts on the wild coast of County Sligo. The finder and Mr. Moir contend that they are paleolithic; others deny the possibility. Each side gives its reasons and the battle rages, for it is scientifically important if Old Stone Age man did inhabit Ireland. Read the article; form your conclusions.

## A Question in Economics

MOST people picture the great northwest of Canada as a bleak, frigid, and barren territory. As pointed out in an article now ready for publication, however, it has tremendous possibilities. The development of rapidly maturing wheat is pushing the wheat belt farther north; meat-producing herds of reindeer will soon abound; and musk-ox, buffaloes, and many other animals provide food and clothing. The territory promises to become a vital factor in world economics.

## Anomaly Island

S O does the author of an intensely interesting article now ready for release, choose to designate Dominica. When Columbus landed, the native men spoke a tongue different from that of the women. At the present, it is the home of a myriad of bats, the imperial parrot, lizards that snap their tails off when attacked, fishes that live out of water, and many other anomalous creatures. It is a scientist's paradise.

## Every Issue Fully Illustrated

**I**The well-informed man or woman is the one who progresses. Why not let the SCIENTIFIC AMERICAN bring to you the latest news of the scientific world in general? The cost is nominal—only four dollars for an entire year's subscription.

# Among Our Contributors

## Tassilo Adam



Dr. Adam, late ethnographer to the Dutch-East Indian Government, recently visited this country and lectured in New York and other places on his remarkable experiences in Sumatra and Java. Dr. Adam combines a purely scientific interest in primitive peoples with what might be called a popular interest in what he observes. Also he has a sense of humor.

## Carl J. Warden

In the Animal Laboratory, at Columbia University, Dr. Warden studies the reactions and behavior of many kinds of animals. In this issue he contributes an enlightening article concerning the psychology of the dog. Dr. Warden's theories are as sound as scientific study and research can make them.

## Sir George Knibbs



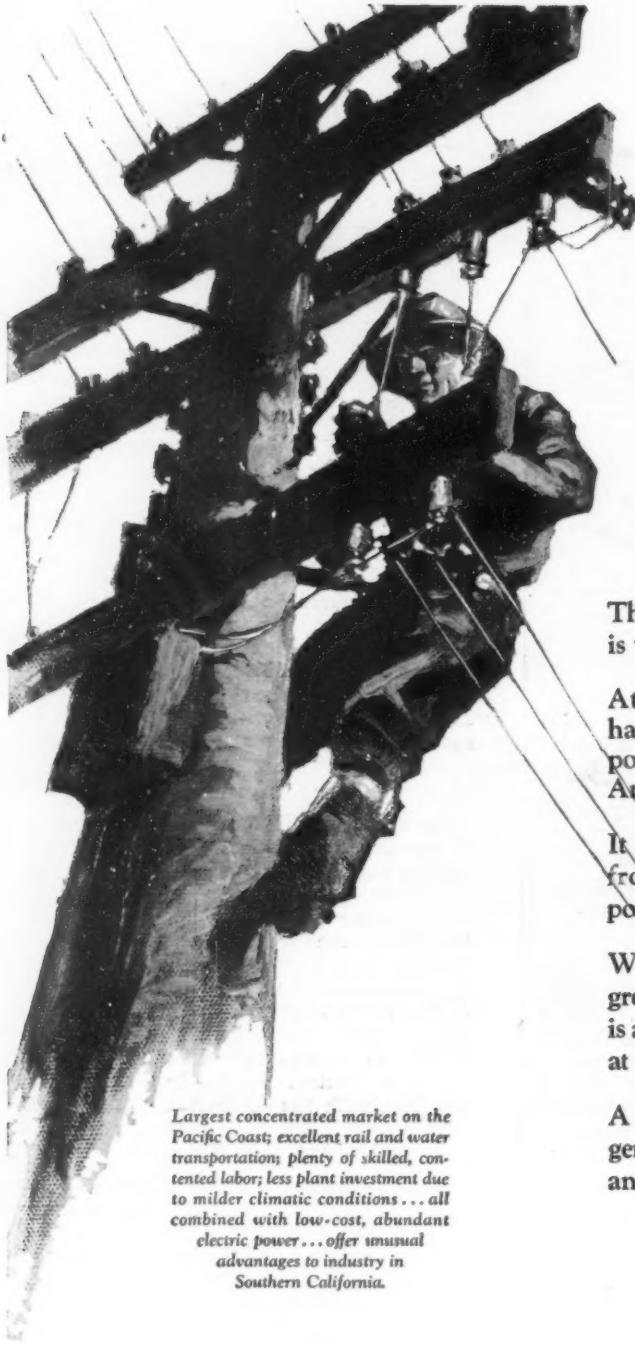
Sir George Knibbs is a famous statistician. He has made a study of population growth and is altogether competent to handle the greatest problem of the future—the overcrowding of the earth. Oddly enough, he comes from Australia where the present problem is to obtain a larger population. He has held many vital positions with the Australian Government.

## Clyde R. Keith

Since coming to the Bell Telephone Laboratories in 1922, Mr. Keith has been engaged in a study of the properties of vacuum tubes and other non-linear electrical conductors, with regard to their use for modulating high-frequency waves with voice currents. Such devices, called "modulators," are used in multiplex telephone systems.

## W. L. Calver

Mr. Calver is a superintendent of mechanics for elevated railroads on week days, but on Sundays he is always off digging up Indian relics, or anything else he can find at old garrison posts and battlefields. His thoroughness as a practical archeologist led to his being chosen to direct the exploration of Montfort, a crusader's castle in Palestine.



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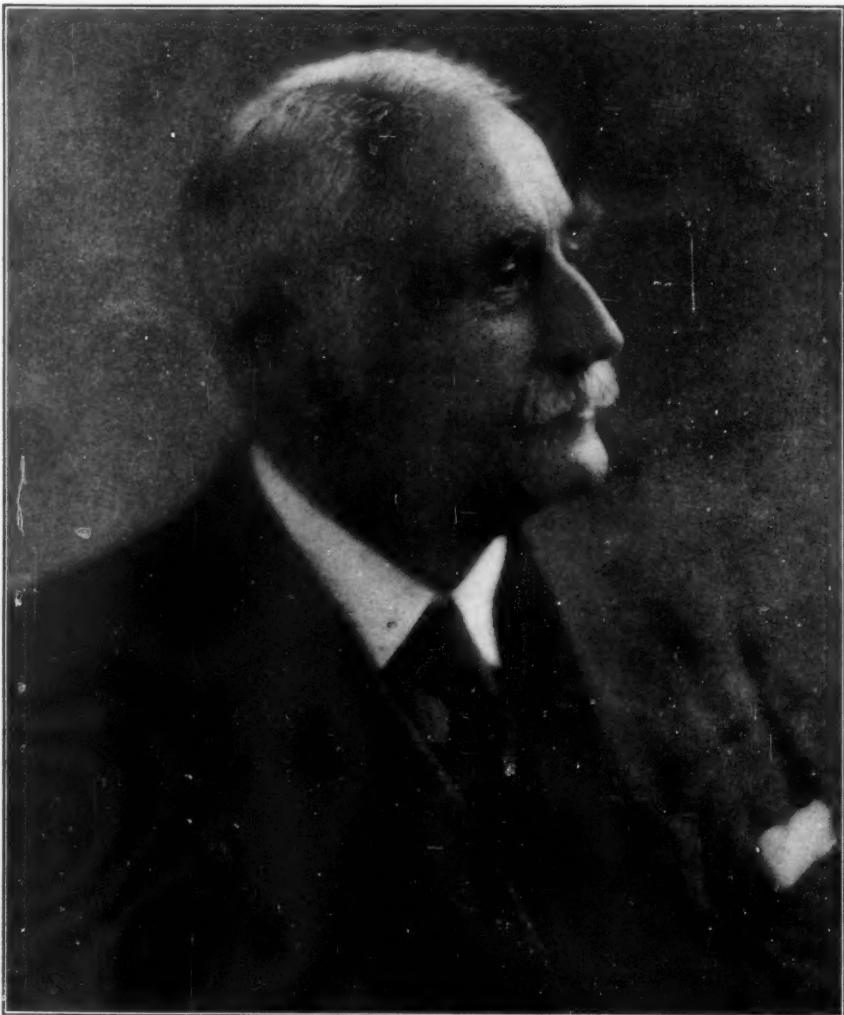
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Charles Francis Brush

AMONG the pioneers of applied science in America, few have attained higher honor and distinction than Charles F. Brush. In 1878 he gave to the world the famous Brush electric arc light and the practical storage battery. During the last 40 years Mr. Brush has devoted all his spare time to research in pure science and has contributed many significant papers to scientific societies. He is a member of many engineering and scientific bodies and the holder of many honorary degrees from institutions of learning. In 1881 he was decorated by the French government for

"Distinguished Electrical Achievement." In 1899 he was awarded the Rumford Medal by the American Academy of Arts and Sciences for "The Practical Development of Electric Arc Lighting." In 1913 he was the recipient of the Edison Medal of the American Institute of Electrical Engineers. In 1928 he was awarded the Franklin Medal by the Franklin Institute for "The Early Development of the Arc Light and the Broad Invention of the Practical Storage Battery;" also, The Cleveland Chamber of Commerce awarded him the Cleveland Medal for "Distinguished Public Service."



Photo by Spencer and Wyckoff

### Fellow

FELLOW, the interesting subject of the article starting on the opposite page, is a pedigreed dog, but there is no reason to believe he began life equipped with especially abnormal innate intelligence. His abilities are mainly ascribed to the fact that he was reared as the children of intelligent people are reared; that is, he was talked to by his owner about as much as one ought to talk to a developing child, and in

grown-up language. As a result, he now reacts to a wide variety of spoken language. Fellow obviously associates certain sounds with definite responses, but it is a question among psychologists whether the response to human adult language is not much the same kind of thing. A rather technical account of Fellow's responses to verbal stimuli will be found in a recent number of the *Quarterly Review of Biology*.



JACOB HERBERT AND FELLOW

*Mr. Herbert of Detroit has made a hobby of fine dogs for years. Fellow, now five years old, has a long line of famous ancestry behind him. Mr. Herbert does not claim that Fellow reasons as human beings do*

## The World of the Dog

*Dogs Are Often Blamed for Shortcomings Really Due to Fundamental Differences of the Senses.  
How Would It Seem to Be a Dog?*

By PROFESSOR C. J. WARDEN  
*The Animal Laboratory, Department of Psychology, Columbia University*

**A**LMOST everyone has wondered at times what sort of a world his favorite dog, or other familiar pet lives in. Naturalists and philosophers have indulged in endless speculation regarding the matter, and numerous attempts have been made to draw realistic pictures of just how the world must seem to infra-human forms.

In general, two opposing principles have guided such speculations. Some writers have followed the tack of humanizing the so-called "mental life" of animals, and particularly the higher mammals. Others have sought to interpret their behavior along narrowly mechanistic lines, holding it to be very different indeed from the higher mental life and behavior of the genus *homo*. The former tendency is best illustrated in the writings of the anecdotalists who flourished for several decades after Darwin, while the latter view is exemplified in the position of Descartes

and of Loeb with his theory of tropism.

Speculations of this sort are no longer held in good repute by sober scientists. Animal psychologists have long since ceased to trouble themselves about matters pertaining to the subjective life of lower organisms. They now speak of the behavior of the animal to the various sorts of stimuli that together constitute the animal's environment, after the manner of the behaviorist in human psychology.

**T**HEY are interested in finding out what stimuli arouse the organism and how it responds to such stimuli, since such knowledge will lead to the ability to predict and control its behavior—and this is the primary purpose of psychology.

It is indeed quite possible to give a comprehensive psychological account of an animal without appealing in any way to human mentalistic terms. The capacity of an organism to be stimu-

lated by different energies and objects in varying degrees and its ability to adjust itself as a whole to its multiform environment include a wide range of problems that can be tested out by appropriate experimental methods in the laboratory and in the field. Fortunately, it is precisely such information as the behavioristic psychologist seeks to obtain concerning animal behavior that will answer the queries of the common man concerning his favorite pointer, or the monkey that may attract his attention at the zoo.

There is no better way to get an understanding of this new psychological principle than to see just how it is applied in a given case. And we have chosen the dog for purposes of illustration because of the general interest in this species which has been so intimately connected with the social life of mankind since long before the dawn of written history.

What do we know concerning the

ability of the dog to see, hear, smell, and in other ways sense the objects which constitute its everyday world? How does the world of dog and man differ insofar as they live in a common world? What evidence of intelligence, using that term in a broadly biological sense, does the dog exhibit in fitting into the somewhat arbitrary scheme of man's life? To what extent, if at all,

make a generalization regarding a given capacity that will be more than approximately true for the canine species as a whole. This difficulty is greatly enhanced by the fact that the tests for one capacity have been made on one breed and the tests for another capacity on another breed. This factor of racial and individual differences is also met with in human psychology although it

the olfactory lobes of the brain. Naturally the animal makes use of the more highly developed sensory mechanism and thus comes by force of habit to make exceedingly fine discriminations as compared with those of the other less-developed senses.

The dog follows the trail to lee-ward when the wind is blowing. Trails a few hours old are not easily followed since the odorous substance left by the foot of the animal tends to diffuse until it becomes wholly dissipated in the air. The crossing of trails often causes confusion, although the trail can usually be picked up again quite readily. It has long been known that a dog cannot trail a man by smell through the snow if the man's boots from which the scent is taken are carefully encased in paper while the man is walking along.

It was accidentally discovered in the laboratory that the dog can detect which of two electric grids is charged, presumably by the slight amount of ozone given off in the one case, and thus avoid stepping upon the charged plate and getting a shock. In general it may be said that whereas man hardly notices the odor of an object unless it is markedly pleasant or unpleasant, the dog lives and moves and has his being in a world of smelly objects.

**I**T is now definitely known that the dog does not see very well, probably possesses no color vision, and hence sees everything as some shade of grey. The retina of the eye is poorly developed, the fovea which man uses in fine visual work being absent and numerous opaque nerve fibers showing through as blind areas. The dog is somewhat inferior to man in distinguishing between the intensity of two lights, and very much inferior in the matter of discriminating between objects of different sizes and shapes. The dog is extremely far-sighted and apparently uses vision mainly in making gross reactions to distant, moving objects.

Sight thus plays a secondary role in the adjustment of the animal to the external world, whereas it is of primary importance in the space-world of man.

The auditory capacity of the dog appears to be quite similar to that of man insofar as ordinary sounds are concerned. The dog can usually hear well enough the sounds that his master can hear, including of course those constituting human speech. And here, the question arises as to what use the dog can make of the spoken language of man.

There can be no doubt but that the dog can learn to distinguish between the sounds represented by different spoken words which may come to serve as cues for specific forms of activity. The most outstanding instance of such ability so far noted is that of the Ger-



MR. HERBERT—MR. FORD—FELLOW

*Mr. Herbert estimates that Fellow knows about 400 words and that he understands these words much as a small child would understand them—that is, as signals for determining his behavior*

does the dog understand and make use of the system of symbolic stimuli which is represented in human language? Some attempt has been made by the animal psychologist to solve these and similar problems, although the present treatment must necessarily be sketchy and tentative.

**I**N the first place, we must recognize the fact that different breeds of dogs differ markedly in respect to any one of a number of capacities. Certain breeds, for example, are superior to others in visual, auditory, or olfactory capacity, and most certainly in general intelligence. Not only so, but individuals within any one breed differ in these respects much more widely than is commonly supposed.

It is very difficult, therefore, to

has been pretty largely ignored until lately.

In discussing the world of the dog we may well begin with the sense of smell, for the common assumption is quite true that the dog lives predominantly in a world of odorous objects. More tests have been made on olfactory sensitivity than upon any other of the senses. Many of these tests have been made in the open and deal with the practical use of the sense of smell in trailing. The common belief that the dog possesses a much more acute sense of smell than does man has been in general upheld by these tests.

There is nothing mysterious, however, in the unusual ability of the dog to trail game, or man himself as in the case of the bloodhound. The organ of smell is highly developed, as are also

man shepherd male, Fellow, whose ability along this line was recently subjected to critical tests in the animal laboratory at Columbia.

Mr. Herbert, owner of Fellow, has talked to the dog for several years past very much as one talks to a child during the earlier months of taking on language. The dog is now able to perform scores of requests, or commands, when given in a purely hit and miss order with his master quite out of sight behind a screen, or in another room. He can also do very well at retrieving a particular object upon request when required to go into another room and pick it out from among three objects placed in a row. Such a task is really more difficult than it may seem, especially when done under test conditions which differ from those under which the animal has been trained.

**A**S is well known, the supposedly mathematical stunts performed on the stage by dogs, horses and other animals, involve nothing more than a highly developed ability to react to minute gestures, or changes in facial expression, often unconsciously exhibited by the trainer. The feat of Fellow went far beyond anything of this sort.

That the dog can make use of human speech-sounds need not mean that he can understand language in the sense in which an adult human being does. Nevertheless, the formation of associations between vocal sounds and specific objects and actions must certainly be one of the first steps in the process of taking on language in childhood. We need not concern ourselves with the academic dispute over precisely what is and what is not true language. It is quite enough to be able to say that Fellow, at any rate, has come to associate human speech-sounds

with definite objects and modes of response, and hence the language of his master enters in an important manner into his world.

How does the dog compare in intelligence with other species of animals? Such a comparison must always be more or less of a rough estimate and with our present limited knowledge of animal behavior would be only a guess. The training and testing of such a complex animal as the dog along systematic lines requires a large amount of time, almost infinite patience, and a well-equipped laboratory.

At the present time no really adequate laboratory for such animals as the dog exists anywhere, except, perhaps, that of Pavlov in Russia. Wealthy dog-lovers appear to be mainly sentimentalists who content themselves by declaiming from time to time on the loyalty of the dog to man without feeling called upon to shoulder the task of establishing research laboratories in which the dog's world might be investigated by competent animal psychologists.

The animal psychologist is amused at times by the naïveté of the dog lover who seriously asks for a scientific opinion as to the intelligence of his pet after a few minutes exhibition of simple tricks which a child might easily teach the dumbest mongrel. Again, he is annoyed at such an attitude, which is in reality an insult to dog intelligence, since it implies that the dog is so "simple minded" as not to require or justify extensive, and incidentally, expensive research.

**S**UCH tests as the psychologists have made, in spite of the serious handicap of lack of adequate laboratory facilities, suggest that the dog is probably one of the most intelligent of the higher mammals. Even an ordinary dog can solve problems requiring the successive operation of several simple mechanical devices, or finding the shortest way through a complicated maze in order to secure food. There is some evidence for supposing that the dog is far superior to the cat in intelligence, and not far below the raccoon and the monkey.

By intelligence we mean the ability of the animal to adjust itself to a changing environment, indicating the capacity to profit by experience. In practical life the dog certainly shows a relatively high intelligence in fitting so easily into the cultural life of man at so many points. With an adequate psychology of the dog at our disposal, some of the vexing questions that have arisen of late regarding the proper place and treatment of the dog in our larger urban centers should be more judiciously disposed of than they can be at present.

In comparing the world of dog and man, the most important differ-



Associated Press Photo

#### THE AUTHOR

*He is shown giving Fellow a psychological test—not an easy thing to do on a dog*



*Most faithfully yours,*

**FELLOW**



#### FELLOW'S CARD

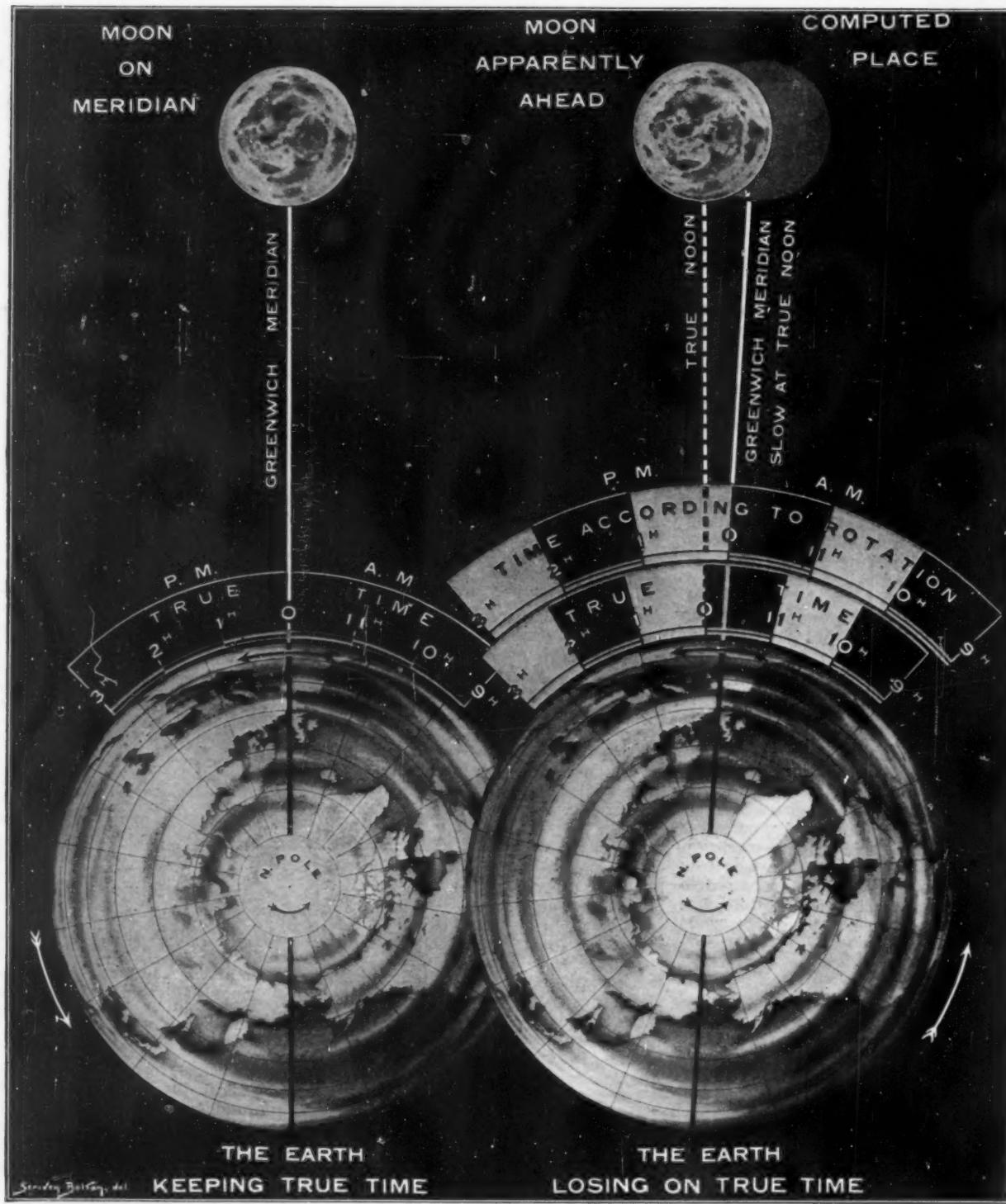
*These "fingerprints" were made in the usual manner. They are reduced to half size*

ence, aside from the obvious point of general intelligence level, would seem to be the predominance of smell in the dog and of sight in man. The dog's world presents a continuum of odorous objects, indistinctly seen and colorless, while the world of man is a panorama of colorful objects, more clearly outlined, but, for the most part, altogether odorless.

The fact that the dog is extremely far sighted should warn us against punishing him for mistakes that he cannot help making. Perhaps the dog makes more use of hearing than of sight, and if so would differ in this respect also from his master. Further studies ought to be made to see how far his ability to distinguish human speech-sounds can be carried. It is useless to attempt to train the dog to "talk" since his vocal equipment is unsuited to the making of articulate sounds.

**I**T is ridiculous to make hasty comparisons of the dog and child as to general intelligence. Specific performances might be compared, although as a rule children are not as yet being tested by the methods that have been developed in animal work.

It is not inconceivable that a common intelligence test for the pre-language child and such higher mammals as the dog, raccoon, and monkey might be developed in time. It might well be based upon general and specific motor aptitudes, sensory discrimination capacity, and the ability to respond to speech-sounds that had become associated with objects and activities common to these organisms and to the child.



### Why the Moon is Apparently Ahead of Its Computed Position

THE drawing shown above, reproduced from the *Illustrated London News*, is an attempt to depict graphically the gradual lengthening of the terrestrial day. With the Moon's position alone as our criterion this change might easily be ascribed to the Moon itself, but studies made by the astronomer Dr. Benjamin Boss and others, indicate that the other heavenly bodies agree with the Moon; therefore the source of the phenomenon must be confined to the Earth. The braking effect of water tides will doubtless account for most of the 1000th of a second per day per

century lengthening of the terrestrial day but in addition to this there is a definite variation or fluctuation in the length of the day over periods of only a few years. Professor E. W. Brown of Yale, a member of the staff of the SCIENTIFIC AMERICAN, believes this is caused by a periodic shrinking and swelling of the Earth, amounting to several inches; the shrinking causes increased rotation, by reducing the Earth's moment of inertia. Perhaps significantly, Professor Boss has traced a definite relationship between the variations in rotation rate and earthquake frequency.

# OUR POINT OF VIEW

## Lightning and Airplanes

**A**PART from its great interest to scientists and electrical engineers, the intensive study of lightning now being conducted by engineers of the Westinghouse Electric and Manufacturing Company in a mountainous region of the south where lightning is known to be of frequent occurrence, may prove of extreme importance to aviators. Captain Carranza, the Mexican flier, and others, have recently been killed by what is thought by some to have been mid-air lightning strokes.

Theoretically, if a plane should pass between two clouds so highly charged that the tension is about to break down in a vivid flash, the plane's metal sheath or parts might so lower the resistance between the clouds as to cause a discharge from one to the other. The results might possibly be the same were the plane to pass under a cloud of which the electrical tension is at a critical point in respect to the earth beneath. In either case the plane that disrupted the static balance would be not only in the path, but would be an actual part of the path, of the stroke. Naturally this would spell disaster for the plane and its pilot.

So far, however, science theorizes on this subject—makes no positive statements. In the meantime airplanes roar their way through rain and storms with apparently little thought of dangerous electrical surges in the atmosphere. And even if science finally decides positively that lightning constitutes a tremendous hazard for the flier, we doubt not that some more adventurous spirits of this highly adventurous calling will fly through storms rather than dodge them, merely for the delight of recounting hair-raising tales of "blue flames and the cannonading of the elements."

## Efficiency's Goal

**M**EN work hard because they are lazy. A vision of leisure, with no necessity for doing anything save follow his whims, has been the impelling force which has made many a man tense his muscles and knit his brow far beyond the needs of the moment. Such labor, with well-earned idleness as the objective—idleness in the closing hours of the day or in the closing years of life—is responsible for much of the world's progress.

Now comes Dr. George Otis Smith, Director of the Geological Survey. Addressing a class of college men, he urges that some degree of efficiency would be desirable in the use of our leisure hours.

"About all that can be said of some of our so-called recreations is that they

serve to kill time," he declares. "The question when and under what circumstances a private citizen is justified in committing time-slaughter may call for an opinion from some high court."

What a wonderful, wonderful system! We work efficiently to have leisure, and use our leisure efficiently so we can work better. But it is not original. It

## D. C. Davies

**T**HE average person has but small conception of the duties of a director of a great museum of natural history. Generally it is thought that he must be a scientist. However, this is not necessary. He must first of all be a good executive, have an intense interest in science and something of an understanding of its problems, and must be able, so to speak, to "keep peace within the family" of curators under his directorship. Such a man was the late D. C. Davies, Director, until his death on July 14, of the Field Museum of Natural History.

"Mr. Davies filled the position of director with the utmost ability, and it is largely due to his excellent judgment and farsightedness that Field Museum holds the high position in the scientific world that it now does, and has made such phenomenal growth," declared Captain Stanley Field, President of the museum, shortly after Mr. Davies' death.

In the death of this business man who successfully directed so great a museum, not only the museum itself but the scientific world at large, has lost an indefatigable worker whose efforts have done much to enlarge the scope of human knowledge. Let his work, then, be his monument; nothing could be finer.

is a clear infringement on the idea of the parent who gave his little boy a nickel for taking castor oil, and had him put it in the little tin bank, and when the bank was full they took out the money and bought a new bottle of castor oil.

## The Modern Rage for the Occult

**I**T is astonishing to a person of scientific leanings to discover in this boasted "age of reason" how many millions of otherwise sane, level-headed, intelligent people still dwell, after a fashion, in the very midst of the Dark Ages. We refer to the recent craze for astrology, the "science" of the stars in their control over the destiny of human individuals. One need only visit the corner bookstore to learn that

there is at present an enormous sale of books on this subject; it has broken into the ranks of the very best sellers.

Astrology was the parent of astronomy, but when astronomy came of age it parted company with the parent, ashamed of its origin. And well it might be. Chemistry was sired by alchemy, whose age-long quest for the elixir of life and the transmutation by some magic formula of base elements into gold formed the creed of a virtual religion—a faith. Chemistry long ago shuffled off the last vestige of the medieval parental influence, but like astrology, alchemy still lives on.

The editor frequently receives from France a journal devoted to alchemy, the official organ of the Société Alchimique de France. From the same source comes a book, "The Chemical Fabrication of Gold," by Jollivet Castelot. By catalytic action Monsieur Castelot lays claim to the possession of the secret of manufacturing gold chemically "by acting on silver mixed with arsenic and antimony sulfides, tellurium and tin."

Not one whit more ridiculous than this, however, is the belief, sincerely held by some persons of the keenest acumen, that the stars exert a subtle influence over our lives. Do these good souls know what the stars are? Let them purchase a dollar book on astronomy, the offspring of their beloved occult study of subtle influences, and find out what sort of a thing is the Universe in which they live.

## Coal and the Future

**T**HREE is little romance, so it would seem, in bituminous coal; it is more dirty than romantic. Yet romance will be put into it by the technological developments of the new age of chemistry which are to be revealed at the forthcoming Second International Conference on Bituminous Coal, at Pittsburgh.

At the coming "conference," which is really a convention, technologists from all the Old World countries, especially from chemical Germany, will assemble. These are not so much coal men as scientists who expect to use coal as a raw material for other things. For example, we shall have men who make fixed nitrogen from coal, rubber from coal, sugar from coal, and gasoline from coal. In short, the best technological brains in the world will be present at the Carnegie Institute of Technology in Pittsburgh between November 19 and 24.

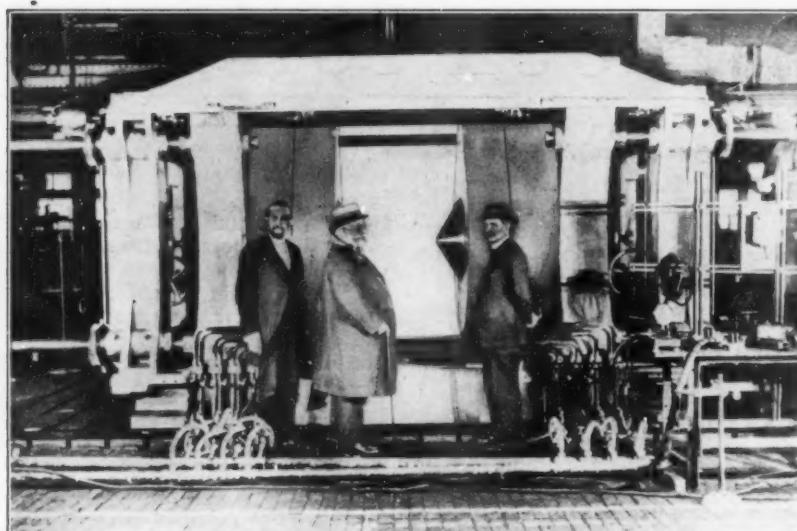
These Coal Conferences are likely to prove pivotal; a new age of wealth and luxury may begin with them.



International Newsred

**CRASH MASK**

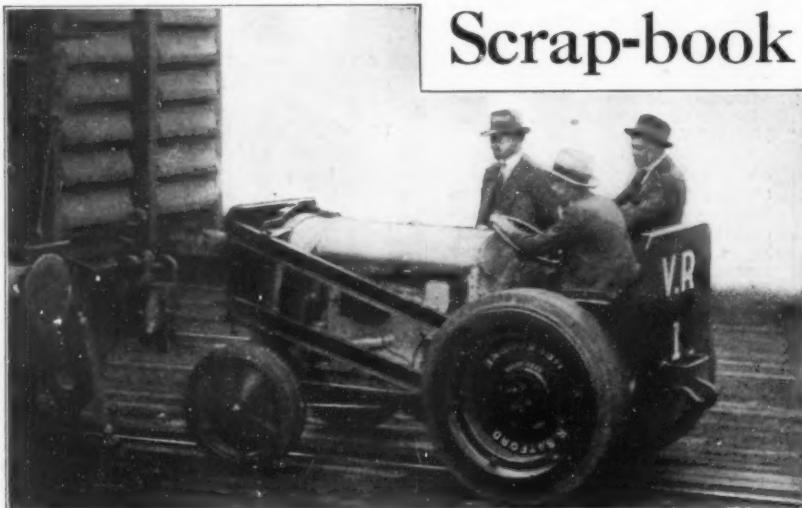
Mask and helmet worn by Les Barker, a motorcycle racer, at the recent opening of the Speedway Track at the Hove Sports Stadium in England



International Newsred

**WORLD'S LARGEST ELECTRO-MAGNET**

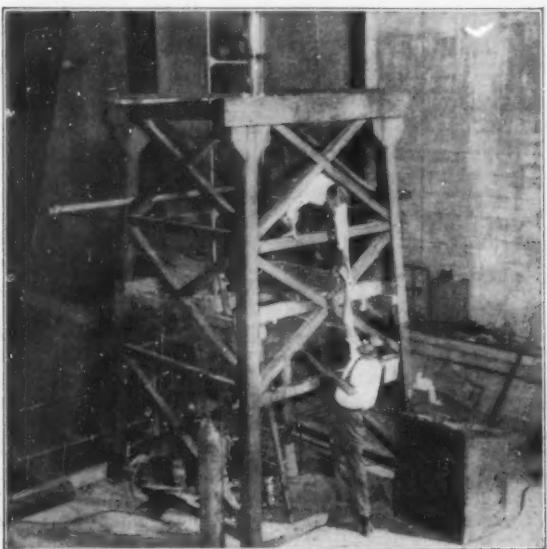
Weighing 120 tons and having pole pieces in the form of truncated cones, this electro-magnet belonging to the French Academy of Science was fitted up by the National Scientific Research Office at Bellevue near Paris. It is to be used by research scientists for the further study of magnetism. There is still much to be learned on this subject

**From the****Scrap-book**

International Newsred

**of Science****REPLACING THE HORSE**

In America, few could imagine a horse being employed to perform such a task. However, on Prince's Pier, Melbourne, Australia, horses were formerly used to shunt cars about the yards. Now this small tractor does the work efficiently



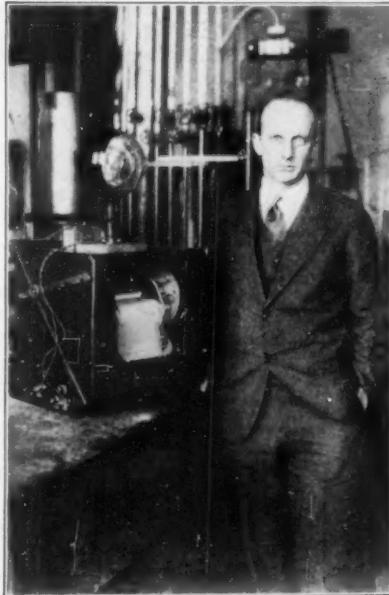
Wide World

**X-RAY LIGHT**

Fifteen feet tall, this giant million-volt X-ray tube—the world's greatest—has been perfected by Professors C. C. Lauritsen and R. D. Bennett of the California Institute of Technology, Pasadena. Capable of penetrating with its rays two inches of lead, it is to be used to seek information concerning the nucleus of the atom

**MEASURING LIGHT ▶**

Dr. L. R. Koller, of Schenectady, and the new daylight recorder he has developed. It is so sensitive that it can record the light intensities in the entire range between starlight and direct sunlight—a range of over a million foot-candles or lumens. The huge photoelectric cell on top of the case is the sensitive eye that starts the work. Fluctuations of the light that is being studied are recorded on the roll of paper shown



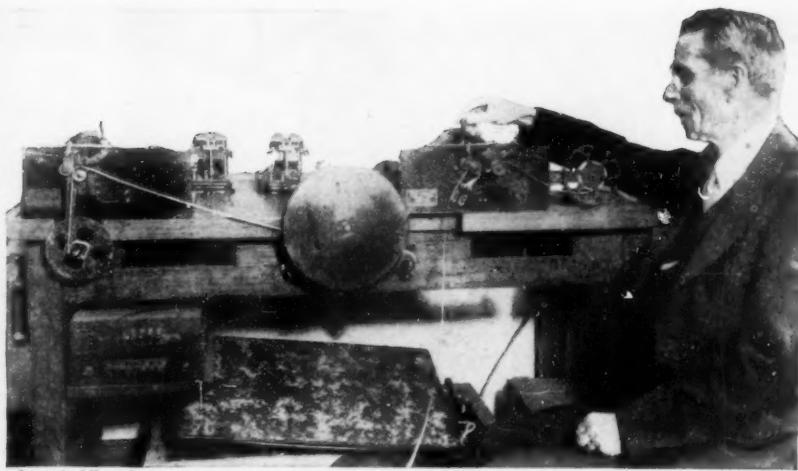
Underwood and Underwood



P and A

**OVER THE PANAMA CANAL**

Interesting view taken from one of the gondolas of the *Los Angeles* as she passed over one of the canal locks



International Newsreel

**MACHINE SENDS 1000 WORDS A MINUTE**

M. A. Noss, electrical engineer, operating the new automatic Telepost telegraph machine which will transmit 1000 words a minute. It is claimed that the machine is so nearly automatic that an inexperienced person can operate it with ease



P and A

**LONDON'S NEW DUSTLESS REFUSE CARTS**

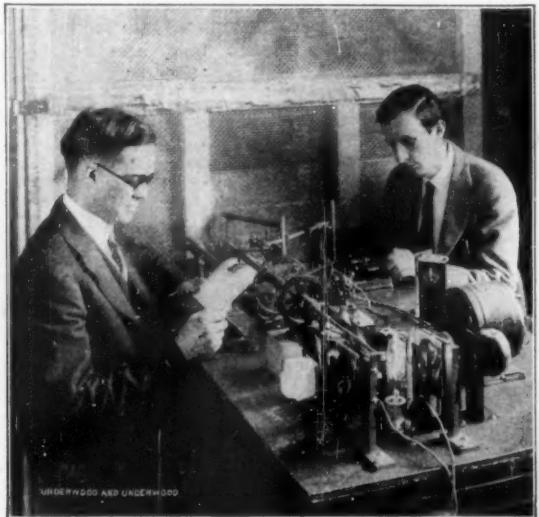
The menace of ash dust and exposure of garbage has been eliminated in London by the introduction from Germany of these new trucks. Collections can be made at the rate of 130 bins an hour. The truck body is a cylindrical tank



P and A

**ENGLAND'S LARGEST SPAN BRIDGE**

Now nearing completion, this new bridge over the Tyne, to relieve traffic between Newcastle and Gateshead, is said to be the largest ever built in Great Britain. It has a span of over 500 feet and will cost about 5,000,000 dollars



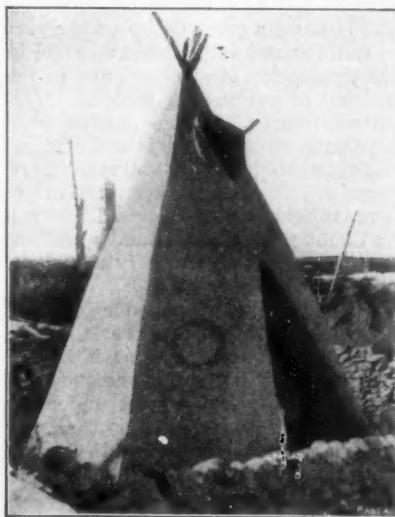
UNDERWOOD AND UNDERWOOD

**COLORIMETER**

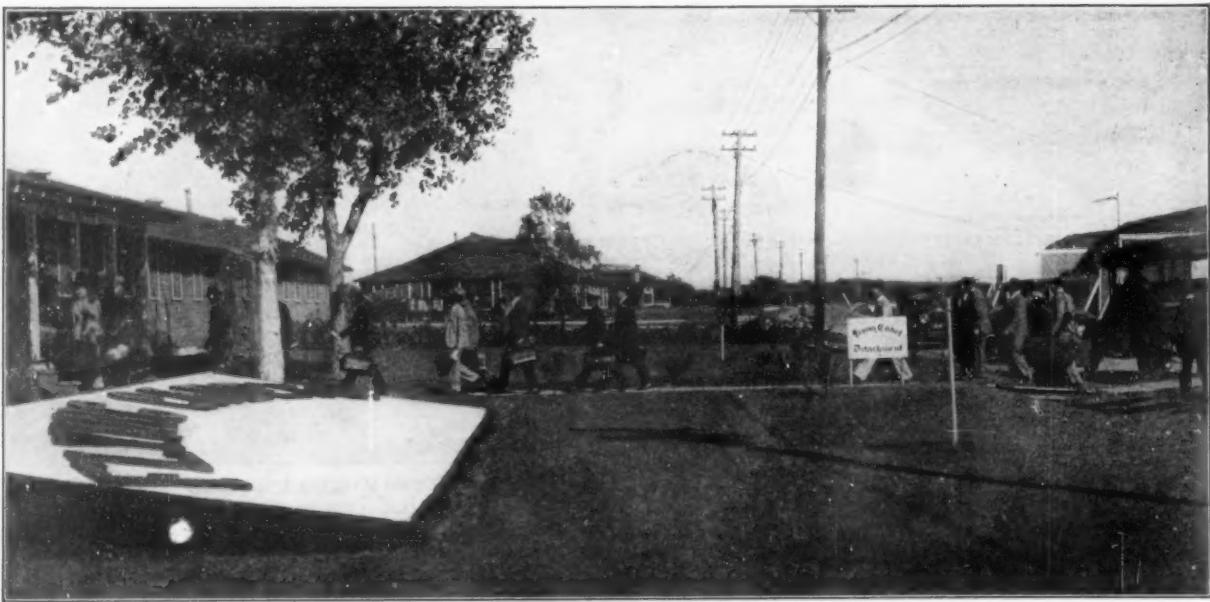
Using a series of lenses, a lamp giving light many times more intense than sunlight, and a block of magnesium carbonate—the whitest substance known—as a basis of color comparison, this new machine for measuring color has been developed by Professor A. C. Hardy and F. W. Cunningham of the Massachusetts Institute of Technology

**TEPEE MONUMENT ➤**

This unique memorial to the Ute Indian chief, Ouray, and his squaw, Chipeta, was built of concrete at Mont Rose, Colorado. It covers the spring from which Chipeta carried water to their camp



PARK



All Photographs Courtesy U. S. Army Air Corps

## ARRIVAL OF "FRESHMEN:" FUTURE PILOTS

*A group of men arriving at the Primary Flying School after having successfully passed the rigid examinations. These men are physically perfect, mentally alert, and psychologically fitted to become pilots; and they enter into this new and hazardous life with great zest and eagerness*

## Youth Hankers to Fly

*Tired of Being Earth-bound, Many Young Men Are Learning to Fly at Uncle Sam's Expense*

By F. D. McHUGH

**N**OTHING in recent years, perhaps, has captured the popular fancy more than aviation. It presents to all a fascinating, adventurous career, and many young men are therefore wondering just how they may learn to become aviators.

Aviation today is in a very healthy condition. The World War first showed the effectiveness of airplanes and induced a great desire on the part of nations and individuals to excel in the production of airplanes and in the making of various air records. This intense interest has done much toward placing aviation on a safe and efficient basis, although there is still much to be learned. The newer generation of aeronautical engineers and fliers will no doubt solve a great many questions that now puzzle the industry as a whole.

**S**INCE Lindbergh's memorable flight from New York to Paris, which served to stimulate a more widespread interest than any other one incident, aviation has gone forward under the force of a great impetus, so that now there is no part of the world that is not "air conscious." Air mail, passenger, and air express lines are rapidly reaching out to all corners of the earth; air-

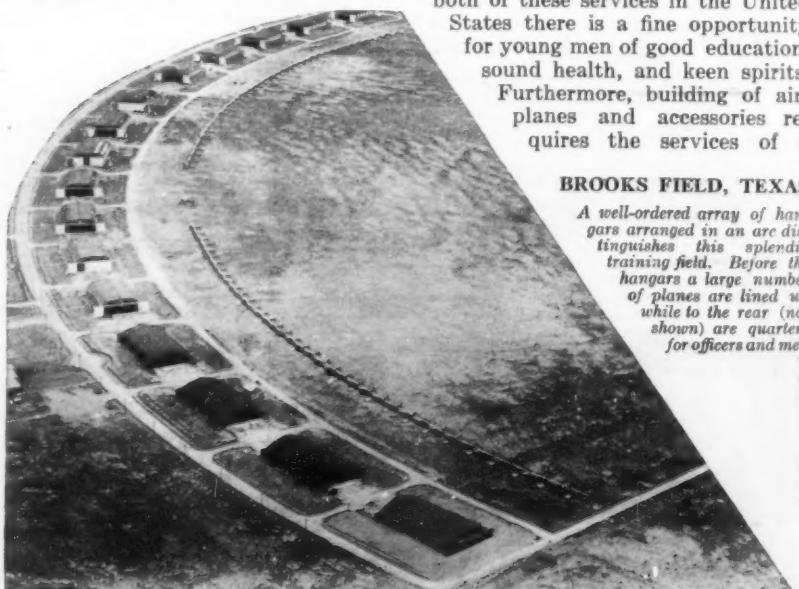
planes are being used for exploratory work as in the case of several proposed Antarctic flights; the Pennsylvania Railroad has planned and will soon place in operation a new transcontinental service in which planes will form several links; and but recently the New

York Central has announced tentative plans for a similar service.

The War and Navy Departments of all governments are naturally interested in airplanes because of their success while still in a crude state of development during the World War. In both of these services in the United States there is a fine opportunity for young men of good education, sound health, and keen spirits. Furthermore, building of airplanes and accessories requires the services of a

### BROOKS FIELD, TEXAS

*A well-ordered array of hangars arranged in an arc distinguishes this splendid training field. Before the hangars a large number of planes are lined up while to the rear (not shown) are quarters for officers and men*



large number of competent designers, test pilots and the like, since there is a special demand for men who, in addition to their engineering qualifications, are also competent pilots.

The Regular Army Air Corps is in need of a large number of new officers, and offers a splendid career for those whose inclination is toward military aviation. To meet this demand the Air Corps maintains a group of flying schools where training is given, at government expense, in piloting aircraft. Graduate flying cadets possessing the necessary qualifications will have an excellent chance to obtain a commission in the Regular Army Air Corps.

**G**REAT fliers are born and not made," according to the statement in a bulletin of the Air Corps. "The ability to fly well—to become a satisfactory military pilot—requires a certain combination of psychological attributes not required by any other activity or effort of man. The majority of men, and even the majority of men who desire to fly, do not possess these attributes."

The flight surgeons attached to the Air Corps, all of whom are specialized psychiatrists, have worked for many years on the problem of determining whether or not a man is a born pilot. Their records show that more than 25 percent of all candidates fail in this regard after having passed all other examinations. Therefore, it can readily be seen that the choice of flying as a career is no more a hit-and-miss proposition than would be the choice of any profession by a young man.

If you are between the ages of 20 and 27, have satisfactorily completed at least two years of college work or can pass an examination equivalent to this, have unimpeachable character, sound physique, and excellent health,



FINAL INSTRUCTIONS BEFORE THE FLIGHT

*An instructor pilot giving a few final words of advice to the flying cadet before the take-off on a flight. Note: the training plane is larger and more sturdy than those that were formerly used*

it is possible for you to obtain an appointment to the Air Corps Flying School. Men with the above qualifications, whether enlisted in the Regular Army, members of the National Guard Air Corps, members and graduates of R. O. T. C. units, or civilians, may be appointed.

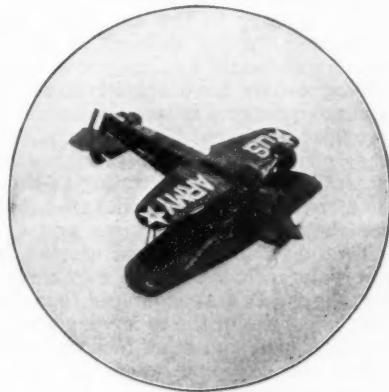
Although applicants may receive either heavier-than-air training or lighter-than-air training (balloon or airship), we shall consider in this discussion only the airplane course of instruction which lasts one year.

**T**HE first eight months of this course are given at a primary flying school of which there are two—one located at Brooks Field, San Antonio, Texas, and the other at March Field, Riverside, California. On completion of the primary training the students are transferred to the Advanced Flying School at Kelly Field, San Antonio, Texas, for the remaining four months of the course.

The Adjutant General, Washington, D. C., will forward to applicants those documents necessary to execute an application properly. These consist of an application blank and an affidavit, both of which are to be returned properly filled out and accompanied by documents authenticating the applicant's education. When this application has been received and approved the applicant is notified to appear before an examining board at some one of a large number of stations, that are conveniently sit-

uated throughout the United States.

On appearing before the examining board, all applicants must first pass a rigid physical examination. This is to determine not only those who are not physically normal, but also those having defects or diseases which might become aggravated by flying, or which



DOING A BARREL ROLL

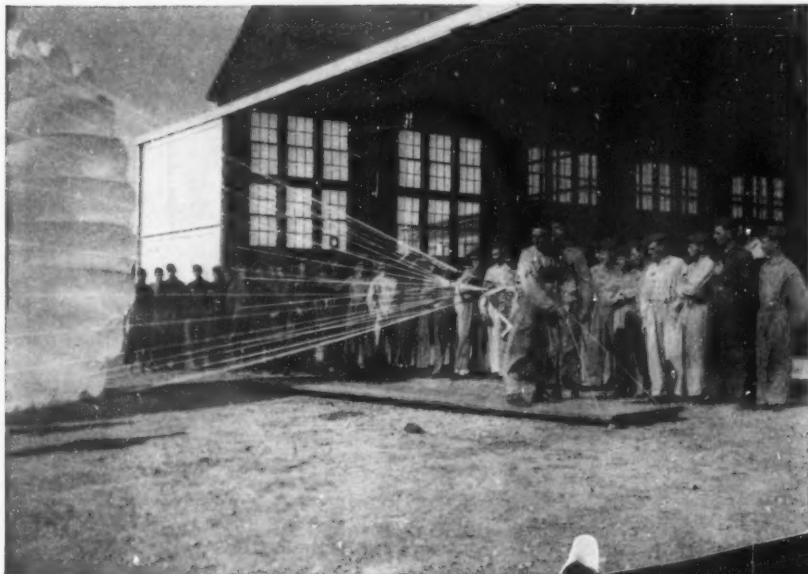
*To be sure this is not trick photography, note the shadow thrown on the upper wing*

would increase the flying hazard. The second part of the examination consists of an inquiry into the applicant's education. This is omitted if the applicant submits documentary evidence as to graduation from or the satisfactory completion of two years' work at a recognized college or university. For those not so exempt, the general scope of the educational examination will cover United States history, geography, arithmetic, higher algebra, plane and solid geometry, plane and spherical trigonometry, and elementary physics. Having successfully passed these, the applicant then takes the psychological test. In this, the flight surgeons give practical tests to determine the applicant's reaction



OVER GATUN LAKE, CANAL ZONE

*Army pilots are assigned to various stations throughout the world where they see from the air much picturesque country*



#### HOW A PARACHUTE WORKS

*Wind from an anchored airplane (not shown) opens a parachute for the cadets*

time under various stimuli; a test on the Ruggles orientator which simulates the evolutions performed in flying; and a personality analysis.

Individuals who are accepted for flying training in the Air Corps are appointed "flying cadets," a grade which was created by Congress in 1919. Flying cadets have special uniforms and are quartered in separate barracks provided for them. They are extended the social and military privileges of potential officers, constituting as they do a body of young men who are noted for their splendid character and excellent discipline. Physical exercise is not only included in the curriculum but the cadets are encouraged to make the fullest use of the swimming pools, tennis courts, and other facilities provided for keeping them in good physical condition.

THE environment is in every way maintained at a standard to be fully in keeping with the gentlemanliness and education of the cadets and the dignity of the service in which they are enlisted.

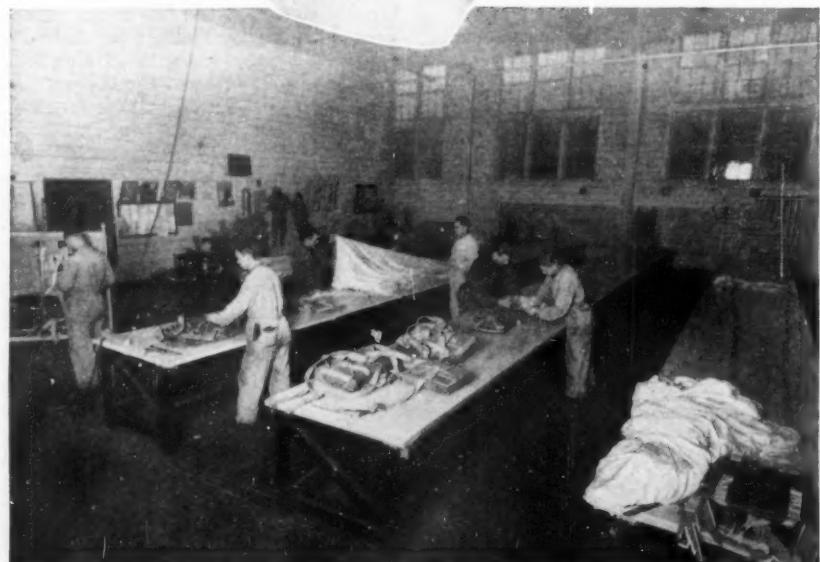
The pay of a flying cadet is 75 dollars a month and his ration allowance is one dollar a day. Uniforms and equipment are furnished without cost. Flying cadets are transferred from the point of their enlistment to the flying schools, and from the flying schools to their homes, at Government expense.

The courses of training at the Primary Flying Schools start on July 1st, November 1st, and March 1st of each year. At these schools the cadet will receive instruction in piloting airplanes, will go through all the maneuvers in which a pilot should be competent, and, on completion of his



#### OPENING

*Unusual view of a jump from an airplane high in the air. The small 'chute opens first and drags the larger pack from its pack*



#### LEARNING HOW TO FOLD PARACHUTES

*Since a human life may depend on the proper unfolding of a parachute in the air, the technique of folding these life-savers is an exact science. Cadets are here studying the method of folding*

course, will have to his credit 75 hours in the air. At the same time he will receive a broad ground training consisting of an extensive study of airplane engines, navigation, machine guns, and radio. Besides these technical subjects, he will be given instruction in various academic subjects. This training as a whole not only broadens the cadet mentally, but also gives him an intimate knowledge of the equipment which he will use.

HAVING successfully completed the eight months' course at a Primary Flying School, the cadet is then transferred to the Advanced Flying School for the remaining four months of his course. He has been receiving instruction in training planes only, but at this school he will use the

regular service planes. The flying training is now more specialized since already he will have completed practically all the ground work necessary. He will do cross-country flying, will receive practice in aerial gunnery, and will participate in pursuit, attack, bombardment, and observation flights.

When the cadet has successfully completed the entire one-year course at the training center, he will be rated an "airplane pilot" and will be classed, without any further examination, a second lieutenant in the Air Corps Reserve. At this time he will have approximately 250 hours in the air to his credit.

Within the limit of appropriation all graduates are then offered duty for a year with the Army Air Corps as second lieutenants. Eventually, it is thought that it will be possible to continue all officers of outstanding ability for a longer period if they so desire. While on this duty they have the privileges, pay, and allowance of a second lieutenant in the Regular Army. This additional service is invaluable to men who contemplate taking the competitive examination held each year to fill vacancies in the grade of second lieutenant, Regular Army Air Corps.

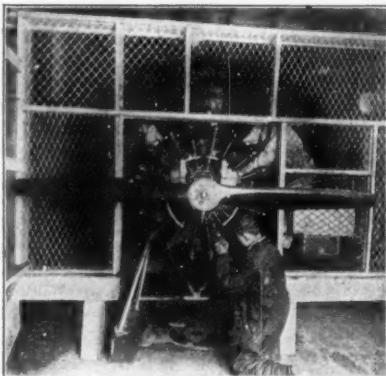
If the graduates do not desire to remain on active duty they are free to return to their homes and their normal civilian pursuits. With the inevitable expansion of aviation, however, many positions in commercial aviation will be open to these graduates. They will be assigned to reserve units in their localities and may report for active duty for two weeks each year if they so desire. While on this active duty, they will be permitted to fly all types of Government aircraft that may be available and on which they are competent. During the remainder of the year they will be allowed to fly Government airplanes at Government flying fields at no expense to themselves.

**T**HE training offered by the Air Corps is an opportunity for which many young men have been looking, and there is no doubt but that commercial companies will recruit many pilots from the graduates of this school. In this connection, youthful aviation enthusiasts who have their hearts set upon becoming fliers, should be warned against the commercial type of school which offers to obtain for them a pilot's license after they have had only 10 or 20 hours in the air.



A GROUND SCHOOL CLASS

*Testing battery ignition units, Department of Mechanics, Air Corps Technical School, Chanute Field, Illinois. The flying cadets go through similar courses but in a less-specialized manner*



TESTING A WHIRLWIND

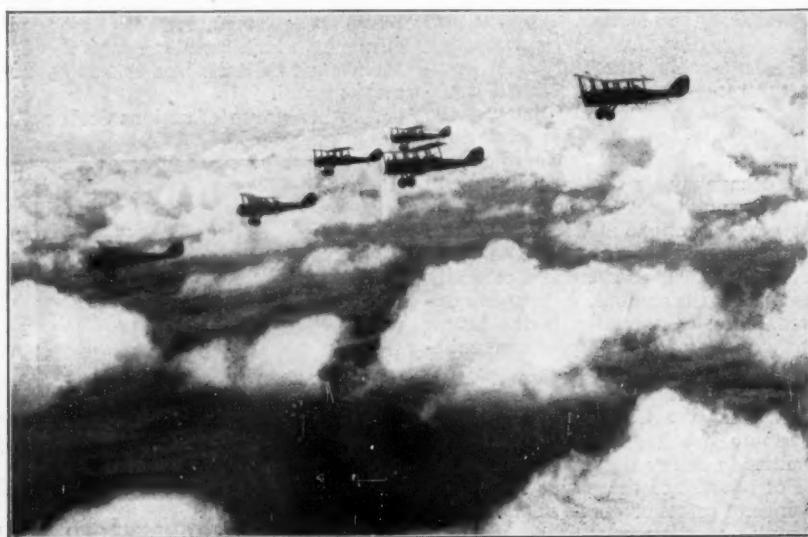
*Students of the Technical School making a test of the famous Wright airplane engine*

Field managers for commercial air transport companies report that they do not consider employing a pilot until he has had at least 500 hours in the air. Some of them limit this condition to solo flying, while others specify that out of 500 hours the pilot should have at least 300 hours over water. Naturally, in every case, such a pilot should know navigation, meteorology, and a great deal about different types of planes.

Besides the flying school described above, the Army Air Corps maintains a technical school at Chanute Field, Illinois. The purpose of this school, which has demonstrated its worth over a period of 10 years, is to train officers and men in the subjects of air communications, photography, aircraft armament, and airplane maintenance engineering. It was organized in order to supply the tactical organizations of the Air Corps with enlisted men properly trained in technical and aeronautical trades to carry on the work of the Air Corps most efficiently.

**I**T was demonstrated conclusively early in the World War that some method was necessary whereby enlisted men could receive standardized training in such trades.

Students for the Air Corps Technical School are selected by organization commanders throughout the army, each station being allowed a certain quota for each class according to its size, requirements, et cetera. In making these selections, commanding officers are guided by the qualifications of the individual, including his aptitude for the type of training to be given. Civilians, however, are not admitted to this school as enlistment in the Army Air Corps is necessary in order to obtain this training.



FLYING SERENELY ABOVE THE CLOUDS

*Flight of R. O. T. C. students of the Massachusetts Institute of Technology, from Langley Field, Virginia, to Bolling Field, Washington, D. C. Note the stretches of field and forest far below*

# World Astronomers Meet

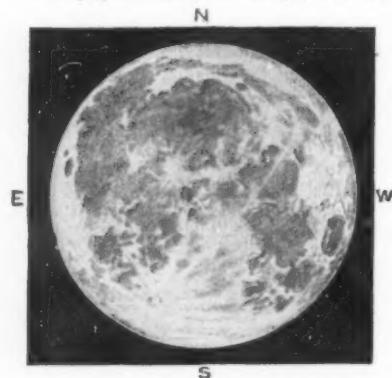
*Every Six Years an International Convention of Astronomers Is Held. What Kind of Affairs Are Transacted at These Cosmopolitan Gatherings?*

By HENRY NORRIS RUSSELL, Ph.D.

*Chairman of the Department of Astronomy and Director of the Observatory at Princeton University  
Research Associate of the Mt. Wilson Observatory of the Carnegie Institution of Washington*

THE writer of these lines has just returned from a great meeting of astronomers from all parts of the world—that of the International Astronomical Union. Held in the ancient university town of Leiden, it brought together for a week of common council in Holland some 250 workers in astronomy and the allied sciences from more than 20 different countries.

The popular idea of the proceedings



THE MOON WITH NAKED EYE

*Astronomical telescopes never show objects in this manner. Various optical elements invert them, reverse them, pervert them or erect them, leading to no little confusion*

of such a conference appears to be rather far astray. The question which the writer is perhaps most often asked, for example, is, "Did you read a paper there?" Such an inquiry is not unreasonable, for at the meetings of individual learned societies such as the National Academy of Sciences at Washington, or the Royal Society at London, the presentations of communications upon the new scientific work is the main business. The same is true of societies which deal with a single science, such as the Royal Astronomical Society and its peers in other countries.

BUT at the Leiden meeting only a single session lasting less than two hours was thus occupied; and this, although crowded with condensed accounts of excellent work, was but an incident of the program. The main work of the modern international unions is of quite a different sort and is done mainly in committee. Leaving to

the various national and technical societies the discussion of the details of scientific advance, however interesting, the international bodies busy themselves mainly with those matters upon which general agreement to work on a common basis is desirable in the interests of science.

Their work is really execution; and in consequence much of their time is spent upon matters of apparently a formal nature such as the adoption of standard values for certain constants of a uniform notation and the like. For example, at the Rome meeting six years ago a set of three-letter abbreviations for the names of the constellations was approved which has already saved astronomers a good deal of money in printer's bills. In this, as in other cases, the action of the union is not mandatory. It cannot compel anyone to adopt the proposed notation, nor does it desire to do so. The system which has received the stamp of general approval will naturally be very widely used; all that is asked of the believers in some other is that they explain clearly in their published papers just what their own terms mean.

BEFORE telling what detailed work the Leiden Conference accomplished, it is a pleasure to speak of its most important feature. For the first time since the Great War a meeting of astronomers was fully and completely international. Formal technicalities even now have delayed the official entrance into the union of representatives of the "enemy powers" of a decade ago; but scientific good-will has outrun technicality and many German astronomers were present at the meeting, sitting with the committees at their sessions and cordially welcomed throughout. Complete international co-operation in the future is thus assured, to the profound satisfaction of everyone.

To attempt to catalogue specifically what the Conference did would dissipate the happy impression in a multitude of dry details. But it may be of interest to those who follow the doings of astronomers to hear of some samples of the work. First we may mention some of those things which, although purely formal, are of practical usefulness. The Committee on

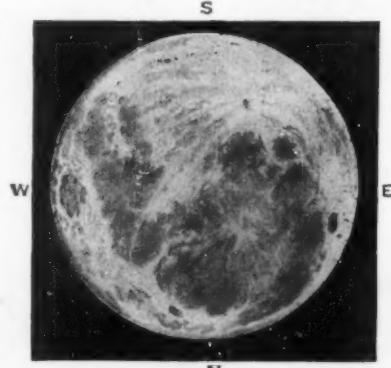
Notations recommended that whenever astronomical photographs are published, the north, south, east and west points of the field of view be marked upon the edge of the plate. Only those who have turned from one work of reference to another in the (perhaps vain) effort to find out which side of a picture of some nebula should rightly be placed up, can appreciate the full value of this policy.

**A**GAIN, the Committee on Bibliography requests that all observatories which issue serial publications, sending out the volumes of their transactions sometimes in several successive parts, should state clearly at the end of each part whether more is to follow or whether the volume is completed. Librarians will bless them for this.

Again, they urge upon authors that in citing references to other scientific papers they shall give full data; for example, not only the number of the volume of a journal but the year of publication. If this is done a misprint in one place such as the volume number will not leave the reader who wished to consult the original paper hopelessly at a loss to find it.

These may seem small matters to take up the time of a gathering of men from 20 nations; but the gain in efficiency which results from a steady attention to details like this is by no means small.

Another group of actions deals with

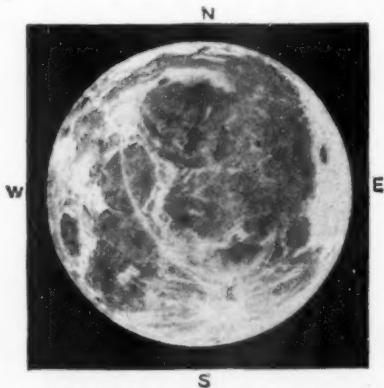


INVERTED AND REVERSED

*An ordinary astronomical refracting telescope turns every element of the object into its opposite. An extra pair of lenses will correct this—but at a certain loss of light*

the adoption of standards of measurement or notation. Here we meet with reports of but a few pages length which represent literally years of work. For example, the Committee on Standard Wavelengths gives a list of about 800 lines—bright lines in the spectrum of iron or of neon and also dark lines in the solar spectrum—which have been measured with great precision by several different observatories. The results are in excellent agreement and the mean values may be adopted as standards for further work. Says the report, "The uncertainty in the final results from iron is only about one part in five millions."

**N**O one who has not actually slaved over precise measurements knows fully what such a sentence means. First comes the laborious, careful designing and setting up of apparatus, the laborious measurement of the photographs and the still more laborious calculations. Then may follow perhaps the heartbreaking discovery after a year or two of work that the results of different investigators using different methods in laboratories thousands of miles apart disagree by one or two parts in a million. This leads to the painstaking search among all imaginable causes of the discrepancy and at last to its detection. When at the end the lurking sources of error have been removed, all that the International Conference has to do is to ratify the decision of the committee of experts and congratulate them on their success.



REVERSED AND ERECTED

*This is a rare condition. The use of a diagonal with a refractor would bring it about. The Hartness turret telescope and the Gerrish telescope at Harvard, give this aspect. All drawings by Russell W. Porter*

Other committees, meanwhile, have been busy with naming things which need labels of one sort or another. A Committee on Lunar Nomenclature has worked over the long lists of names which have been assigned to the mountains, craters and other surface features of the Moon and tabulated those upon which there is general agreement and the relatively few which have been given different names by two

or more authors. Here it is evidently not so important what names are assigned as that their significance should be definite. Only a report of progress has so far been made but perhaps by the next meeting of the union the matter will be decided.

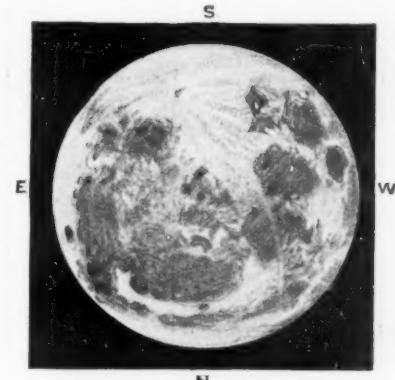
Similar questions had to be considered by the Committee on the Classification of Stellar Spectra which proposed a number of symbols to denote stellar spectra of different sorts. It would surprise the outsider to see what lively discussion sometimes arises in committee on such questions as, whether the presence of bright emission lines of metals in a star spectrum should be denoted by the letters "em" or by others; but the whole point of such meetings is to get such matters thrashed out. The final conclusions in such cases as the writer met with were often unanimous and when they were not, the minority accepted the result with an excellent good grace.

The needs of astronomy in the future also come under consideration. The funds at the disposal of the Union are limited, but appropriations of a few hundred dollars each were made to assist in the completion and publication of a considerable number of works such as a list of observatories and of the astronomers working at them, lists of variable stars in special need of observation, charts of solar phenomena, and the like.

A PARTICULARLY good example of the usefulness of a general gathering appeared when a request was made for observations of comparison stars for the asteroid Eros. This remarkable planet in 1931 will come very near the Earth and the opportunity of determining its parallax and hence the distance of the Sun will be exceptionally good. The observations like those of 1901 will doubtless be mainly photographic and every precaution must be taken to secure accuracy. The color of the planet and of the stars which are used as standards for determining its position will be a matter of importance. Light of different average color is refracted in the Earth's atmosphere by slightly different amounts, and if the color of the planet and the comparison stars are different, errors will creep into the final result. It was therefore requested that plans be made for determining the color of the planet and the colors and spectrum of the stars already selected as points of reference. Within five minutes after this matter had been brought up in committee, the directors of three different observatories all especially fitted to work on such problems had agreed to see that the desired thing was done.

Little space remains to tell of the things that were announced at the single session at which reports of new

work were made. Mr. Evershed, who, after long and useful service in India, has retired and set up an admirable private observatory at his English home, showed some noteworthy spectroheliograms of the Sun taken with infra-red light, using the great calcium line at wavelength 8542, in a region which a few years ago could not be



INVERTED AND RE-REVERSED

*The diagonal mirror of a Newtonian reflecting telescope again changes the rays—but in one plane, only—in other words, the diagonal puts back to the naked eye aspect of one of the two dimensions, but not the other*

photographed at all. These lines are closely related to the great *H* and *K* lines in the violet, but the infra-red photographs to everyone's surprise showed much less conspicuous bright flocculi near the spots than those obtained with the violet lines.

Dr. B. H. Dawson—born in the United States but now working in Argentina—reported on a double star which he discovered four or five years ago. His observations, combined with those of Dr. Van der Bos in South Africa, shows that this is a binary with a period of only three years and a half—shorter than any previously known. Finally, mention should be made of work by Dr. Baade of Hamburg which indicates that certain faint nebulae which he has studied are at a distance of at least a hundred million light years.

THESE fragmentary glimpses from a full program may serve to give some idea of what astronomers talk about when they get together in force. Much more in the way of purely informal agreements, and of plans to bring the needs of younger workers of limited resources to the attention of the great foundations for the endowment of research, may better be suggested than told; but there can be no doubt that the Leiden meeting was a success.

**Q** Keeping track of several hundred "pocket planets" is a fascinating pursuit, and finding new ones is a suitable pursuit for the amateur astronomer. Next month Dr. Russell will explain how this interesting work is performed.

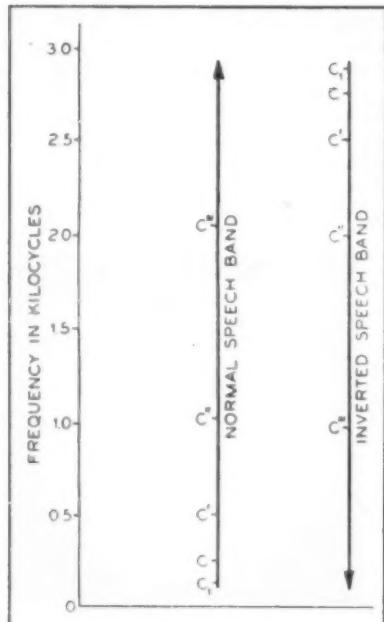


Figure 1: This shows how the normal speech band is inverted in the apparatus

**I**N translating spoken words from one language to another, the interpreter produces new sounds which are equivalent to those of the original language in meaning but quite different in physical make-up. If there were a definite physical relation between the sounds making up the words of one language and the sounds of the corresponding words in the other language, it should be possible by means of suitable apparatus to translate speech automatically from one language to another.

Since there are no such definite relations between existing languages, no mechanical or electrical device can take the place of an interpreter for translating from one existing language to another.

**H**OWEVER, it is possible to translate automatically sounds of existing languages into other sounds which are equivalent to a new language. Similar apparatus may then be used to translate these new sounds back to the original language from which they were derived.

The most obvious use for a device capable of performing this feat would be in a communication system for rendering ordinary speech unintelligible during transmission, and then translating it back to its normal form at the receiving end. This is, in fact, the basis of most secrecy systems, but, alone, it is not sufficient for complete secrecy since it would only be necessary for the eavesdropper to learn the new language in order to obtain the message.

However, it is of interest to consider one of the simpler methods of making

# New Languages from Old

## How Secrecy Is Gained by the Inversion of Speech Sounds

By CLYDE R. KEITH  
Research Department, Bell Telephone Laboratories

artificial languages since it illustrates in a striking manner the process of modulation or frequency conversion which is so essential to radio and carrier telephone communication. This method is called "inverted speech," since for every sound vibration a new one is produced whose frequency is equal to some arbitrary constant frequency minus the original frequency.

Such an effect is daily obtained in every radio broadcasting transmitter, but in that case the band of transmitted frequencies corresponding to speech is so far above the audible range that it is unintelligible for that reason alone. But if the constant or inversion frequency is decreased to a point below the upper edge of the voice band, the resulting waves are all audible frequencies. They are, however, differently arranged from those in the original speech, and to the ear they seem to have no relation to the original. The present apparatus, built by Bell Telephone Laboratories for demonstration purposes, employs an inversion fre-

quency of 3000 cycles and utilizes only the speech frequencies below this.

As a result of such an inverting process, new audible frequencies are produced corresponding to each of the original speech frequencies, and located just as far below 3000 cycles as the original frequencies were above zero. Using a normal speech range of from 100 to 2900 cycles per second and an inversion frequency of 3000 cycles, the resulting inverted speech also occupies the band from 100 to 2900 cycles but in the reverse order.

**T**HE relation between normal and inverted speech bands is shown in Figure 1 in which the octaves above and below middle C are given for reference to musical pitch. The effect may be compared to that of a lens in forming a real image of an object: the top is made to appear at the lower part of the field and the bottom at the upper part. A pure tone having the pitch of middle C on the piano scale, which has a frequency of 256



INVERTING AND RE-CONVERTING

Figure 2: S. P. Grace is shown holding a telephone near a phonograph which is giving out inverted speech sounds. The portable set once more inverts the sounds and they come out of the loudspeaker in unscrambled condition, just as they were originally spoken in plain English

cycles per second, becomes 3000 minus 256, or 2744 cycles. Consequently the voice of a person talking in a low pitch comes out of the inverting apparatus as a high pitched squeak, with a low grunt now and then due to the overtones in the original speech wave.

**O**N listening to inverted speech for the first time it is impossible to understand a single word, although it is apparent that it is some form of speech on account of the characteristic inflections and marks of emphasis. One may, however, learn to interpret it by listening to known words as reproduced by the inverting apparatus. For instance "telephone" sounds very much like "playafeen" and "Illinois" becomes "Oyanail."

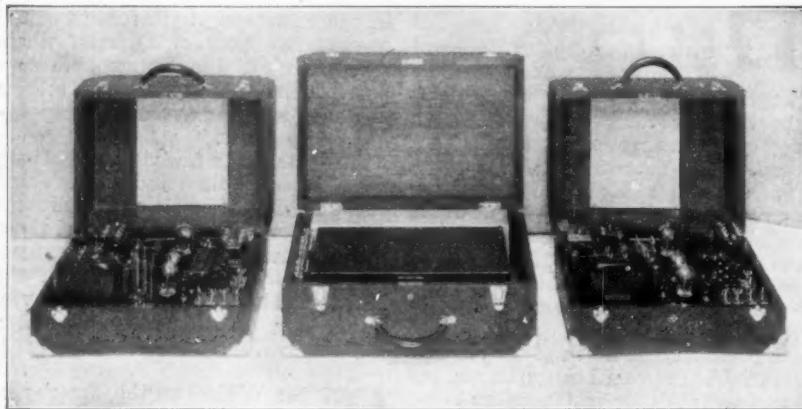
Then it is possible to learn to speak the inverted language by imitating the sounds coming from the inverting apparatus. However, this is not likely to be entirely successful since the process of inversion destroys the harmonic relation between the original speech frequencies. For example, if middle C and its second harmonic, upper C, are inverted, the resultant frequencies are 2744 and 2488 cycles, which are not harmonics and therefore could not be produced simultaneously by the human voice.

Nevertheless, it is possible to imitate some of the inverted sounds sufficiently well to produce intelligible speech when reinverted. Since the intelligibility of reinverted speech depends only on the fidelity with which the inverted sounds are imitated, very good quality may be obtained if they are recorded on a phonograph

for reinverting the recorded speech. These have been used frequently in demonstrations given in connection with lectures by Mr. S. P. Grace on "Recent Inventions of Bell Telephone Laboratories" before numerous gatherings of telephone engineers.

In the demonstrations the records are played on an ordinary phonograph to show how little resemblance the sounds bear to normal speech. Then some of the inverted speech sounds coming from the phonograph are picked up with a telephone transmitter and reinverted by the portable set shown in Figure 2. As a result the reinverted or normal speech comes from a loud speaker on the other side of the stage. The unintelligible sounds coming from the phonograph may still be heard, but only faintly, since they are largely masked by the greater volume of normal speech. To show that the reinverted speech actually comes from the peculiar sounds given off by the phonograph, the telephone transmitter is removed, whereupon the translated speech dies out.

**I**N the actual apparatus, two modulating steps are used which give the same overall result that would be obtained from a single modulation with a carrier frequency of 3000 cycles. This is necessary because it is difficult and sometimes impossible to remove some of the distorting current waves which are unavoidably produced by ordinary modulators when the desired output frequencies occur in or near the original speech band. But by first modulating the voice frequencies with a high-frequency carrier (20 kilocycles) and then



THE INVERTING SET BUILT IN PORTABLE FORM

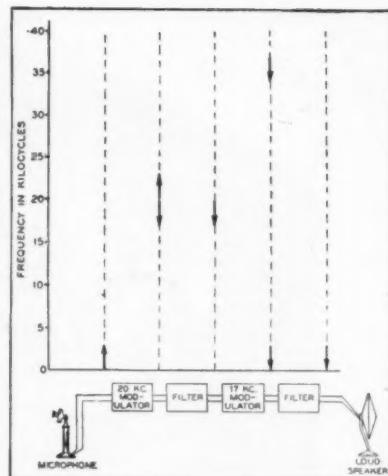
Figure 4: The box in the center contains the two filters for separating the frequency bands. Each of the other boxes contains a high-frequency vacuum-tube oscillator and a modulator.

record and then reproduced from it.

Records of inverted speech were first made about two years ago by Mr. J. W. Horton to illustrate the use of high-frequency carrier currents in multiplex telephone communication. About a year later a number of high quality records were made with improved inverting apparatus, and a portable outfit built

modulating the lower band of frequencies so produced by another carrier 3000 cycles lower (17 kilocycles), the distorting components are so widely separated that they may easily be removed by means of devices called filters.

The inverting process may be followed by reference to Figure 3 in which



#### THEORY OF THE PROCESS

Figure 3: The arrows represent frequency bands produced by the apparatus shown

the heavy vertical arrows represent frequency bands produced by the apparatus. Following the diagram from left to right, the initial band of frequencies coming from the microphone modulates a 20 kilocycle carrier frequency and produces bands of frequencies above and below 20 kilocycles.

After the upper band is removed by a filter, the lower one is modulated by a 17 kilocycle carrier. This gives one high and one low frequency band of which only the lower one is retained. This completes the inverting process, for the resultant band then occupies the same frequency range as the original voice band, but in the inverse order. The steps necessary in reinverting the inverted band to normal speech would be represented by the same diagram with each arrow reversed in direction.

**I**N Figure 4 is shown a detailed view of the reinverting set, which consists simply of laboratory apparatus built into portable form. The center box contains the two filters for separating the frequency bands, while each of the other two boxes contains a high-frequency vacuum-tube oscillator and modulator. Particular care is necessary to keep the first modulator's carrier from being transmitted to the second, since this would cause a constant tone of 3000 cycles, which would be quite objectionable.

Although the apparatus and methods described above are not of commercial value in themselves, they illustrate some of the important principles used in multiplex carrier telephone systems and in radio broadcasting. One of the most remarkable features brought out by such a demonstration is that the original speech waves can be transmitted through all the apparatus necessary for inverting it and then reinverting it, and still come out so nearly like the original speech.



THE DJENANG AND THE GROUP OF KUBU SAVAGES

*The second man from the left is the chief and is the most intelligent—or the least unintelligent—of the tribe. Others of the group are mentioned by the author. To win the confidence of these timid people demands no little deliberation and patience*

## The Kubu Forestmen of Sumatra

### *An Expedition to One of the Most Primitive Peoples on Earth, Who Dwell in the Primeval Forests*

By Dr. TASSILO ADAM  
*Late Ethnographer to the Dutch-Indian Government*



KUBU WOMEN

*As with all primitive people, a woman of thirty is old in everything but actual years*

DURING my sojourn of 20 years as a planter in northern Sumatra I had frequently heard of the remarkable nomadic people who were said to live in the virgin woods of the southeastern part of that large island, and when I came to the mountain districts of the south, to the highlands of Palembang and Bengkulen, I heard still more of the people, who "ran away like timid deer or climbed into the trees like monkeys" on seeing a white man.

Through my exhaustive studies of the Battak people in northern Sumatra I had learned much of the customs and habits of primitive people, and my most ardent desire was therefore to get acquainted with those mysterious forest dwellers and to ascertain which were really true of all the doubtful tales.

What was my joy when I was commissioned by the Dutch-Indian Government to make an expedition of exploration through the southeast of Sumatra, in order to make photographs and prepare descriptions of these tribes.

Though several essays on this people had already been published, none of

the authors had to my knowledge been in the enormous virgin forests of the present residency of Djambi, where those tribes of the Kubus were supposed to live who had never or seldom met even with Malays, and Europeans absolutely never.

After staying a few weeks in Muara Bungo, a small place and the residence of a Government official, situated some days travel up the Batang Hari river, I at last receive a report from the messengers sent out, that some of the Kubus had been found in the primeval forest at a distance of about half a day's march.

ON the advice of the *demang* of Muara Bungo—the highest native official—I sent ahead some of his people led by the *djenang*, who is the only Malay who knows how to deal with the Kubus and who to a certain degree has their confidence, with presents consisting of rice, fruits, clothes, knives and spear-heads, in order to inspire the timid little people with confidence, so that they would not run away on seeing me.

The next day at 5 o'clock in the morning, I started with the *demang*,



ONE OF THE NATIVE HUTS

*A few upright sticks are stuck into the ground and a meager "roofing" of palm leaves is depended upon to shed the rain. This is the whole house of a Kubu. It can be constructed in an hour*

about ten bearers and the inevitable *djenang*. After a march of about five hours we reached a place in the midst of the tall virgin forest, where shrubs and undergrowth had shortly before been cut away, and where in some huts the long-sought Kubus were found quietly sitting.

What a strange sensation to find oneself with such people for the first time in the middle of the mighty primeval forest! Even for me, who as a planter was accustomed to the natives and had often passed the night among the Battaks, at that time very primitive, it was a grave moment. At first perhaps the same thing happened to me that happened to these people: they saw for the first time a white man, and I saw for the first time a pygmy people in a state in which I had never seen one before. Nobody spoke a word . . . utter silence . . .

I ORDERED my bearers to lie down beyond view of the Kubus, only the *djenang* and the *demang* remaining with me. After having made myself comfortable with the box containing my photographic apparatus as a seat, I took a hearty draught from my camp-bottle and ate leisurely some bananas, to make it gradually clear to the people in this manner that they had no cause to be afraid of me. Of weapons I never carried any on my excursions, because it is my conviction that it is easier to gain the confidence of the people if one comes to them without a gun or revolver.

The close, damp air of the tropical forest, the sun standing vertically over head, the horrible smell of the remains of beasts eaten by the Kubus, which they have thrown about, and the abominable scent exhaled by the Kubus

themselves—all these put my otherwise useful and loyal companion, the *demang*, in a humor which was anything but congenial. Also these wild people were not to his taste, and he could not understand why I took an interest in them and could endure staying here quietly for such a long time.

FOR a planter who had been obliged for 20 years to deal with Chinese coolies, even such a situation was, however, still far from unbearable, while the little crew who were sitting in front of me engaged my attention much too closely for me to heed the grievances of this official.

The Kubus continued to squat in front of me. Only the children disengaged themselves after a time from their mothers, who may have been too afraid at first to approach, and crept from one adult to the other. The entire little tribe mustered only 14 heads: three men, four women and seven children. My first impression of them might be called strange but not bad.

I was struck most by the fact that all, especially the children, looked well nourished, but I was disappointed when the *djenang* said to me, "This is only so today, for they have eaten at once all the rice and the fruits which I sent to them. Otherwise this is a very sequestered tribe, difficult to reach. Only rarely do they get rice and bananas, sometimes through me." He also explained to me that they did not understand at all how to cook anything, but ate everything in a raw state, or at most a little fried over, and without any spices, even without salt. The scraps of food which I saw lying about fully bore witness to his statement.

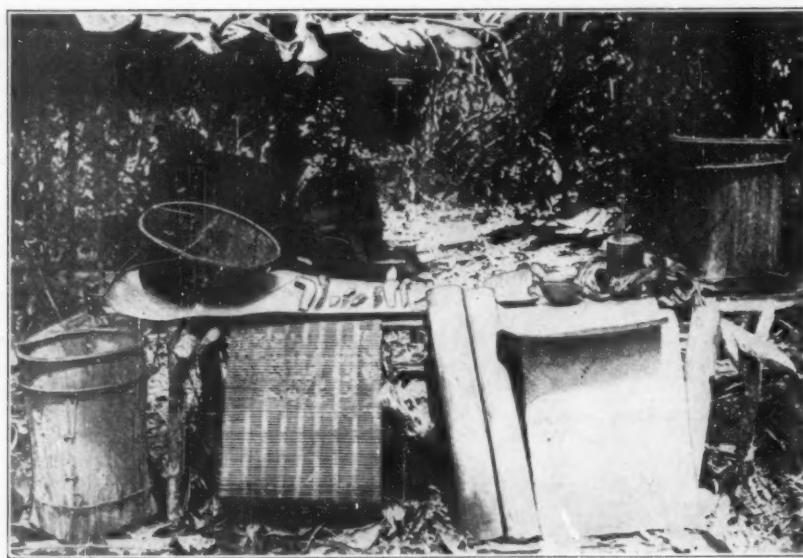
ON looking at these savages more closely I came to the conviction that I had before me one of the most primitive people of the earth—miserable, wholly neglected people, without culture.

I may have sat thus for half an hour in conversation with my own companions, when I thought the moment had arrived to start an exchange of words also with the strange tribesmen we had come to see. The *djenang* served as an interpreter, partly because I could not yet understand the dialect, and partly because they had more confidence in him. The second man from the left in the group photograph was the chief of the group and perhaps the only one from whom a reply could be expected. While I formulated some questions to be addressed to him, which, after some



HOLDING AN AFTERNOON "AT HOME"

*The "beds" show in the background. The sides are open, not only to the elements but to the wild animals that roam through the virgin forest. Our own ancestors may once have lived like this*



THE COMPLETE HOUSEHOLD FURNISHINGS

*Two mats, three bamboo water "buckets," two baskets, some knives, a tinder box, a drinking cup (cocoanut) and a bamboo box—this is the whole inventory of the rude Kubu establishment*

reflection, he answered slowly and in monosyllables, I took a stroll around, as composedly and innocently as possible, in order to glimpse more closely all those present and to take away all fright and shyness.

**S**OON I was overcome by a feeling of pity, for the skin and hair of all of them were in a frightful state, most of their bodies were covered with a sort of fine scales like those of fish—an abominable, very bad-smelling and infectious disease—their hair was disheveled and full of unwelcome tenants. Even the *djengang*, although himself a native and therefore certainly not as over-sensitive as a European, could not accompany me to the end on this inspection. He disappeared for a time and then returned as white as chalk, thoroughly cursing "this disgusting visit."

With the exception of the chief, the men and women did not impress me as being very intelligent. The younger man near the center, with the scanty, full beard, looked outright idiotic; neither could he be induced to answer my questions. While I took the photographs the position of the hands was quite typical of most of them: involuntarily the finger nails are continually scratching the skin, which certainly itches in an urgent way.

The gait of these people is very elastic, quick, and agile, but their whole mode of life makes them terribly lazy. Only if driven by hunger will they go in search of food which consists chiefly of herbs and fruits; especially, however, of the meat of "everything that moveth." Whether it is generally true that they do not kill or eat snakes and crocodiles, I should like to see further substantiated, for there are tribes of

the Battaks who eat dogs and monkeys, whilst with others such a thing would be considered a disgrace.

The *djengang* spoke with the chief, the others only harkening to the conversation at first. Soon, however, this interest gave place to their general indifference, and most of them sat down again or lazily stretched themselves out.

From what has been said already it will be seen that any attention to bodily cleanliness is quite beyond them; the useful employment of water is absolutely unknown to them. "A Kubu does not bathe." This had already been told me before, and here I could find the confirmation of this assertion.

**J**UST as with the Battaks, we find here two quite sharply varying types: one of a rather good average height, slender, mostly thin, the head also long and narrow, the nose well shaped, thin, sometimes even hooked, the mouth not very broad, with thin lips. The other and more common type, is of a shorter, heavier build, with broad shoulders, thick set, short foreheads, coarse features, protruding cheekbones, thick noses with wide nostrils, large mouths, heavy lips. That many of these inhabitants of the forest show a nearly Mongolian admixture, there is no denying. Further, some are conspicuous by their upper body being proportionately longer than the extremities.

The growth of hair on the body is very scanty, but abundant on the head. It is of a dark brown-black color. At what time it starts to get gray could be fixed only by conjecture, as with these people even approximate statements of age are out of the question. If we find short hair with women and

particularly with men, then it is cropped with the ordinary bush-knife; or rather it is sawed off with it, which explains its irregularity. I could not find any really curled or deep black hair, as described by others, except that in some individual cases it is somewhat frizzled, and with women, wavy. With the men, whiskers are altogether absent. I met only with thin, stubby moustaches, and beards around the chin. The eyebrows are as a rule very thin, the same as the eyelashes.

The huts in which these strange creatures were sitting or lying can scarcely claim the name of dwelling, consisting only of freshly cut sticks stuck in the ground and bound together with rattan. On these were only just enough palm or tree leaves to keep off the heavy rain. At a height of about half a meter there were a few crosspieces of wood, some of them split, on which they lie. This is the whole house of a genuine Kubu.

**T**HE Kubus are a wandering people. If the place where they have settled down does not afford sufficient food, they move on and erect their shelters on another spot at the shortest notice. These abodes do not offer the least protection against wild animals. Neither does a watchman guard them against attack at night. They sleep without a torch fire, left completely to their fate.

The whole of the household goods and also the complete hunting outfit are shown in the illustration above. More possessions than this are not owned by a Kubu family. We see here two plaited mats, not plaited by the Kubus but



A TRANCE

*One of the men goes into a hypnotic state and must be supported by the aid of others*



TWO KUBUS

*Obviously these are physically far from the "noble savage" ideal of the romantic writers*

acquired through barter from Malays, a hanging mat of plaited split bamboo used partly as a sleeping mat (partly also to keep food), three long bamboos for water-containers, two baskets made of bark to be carried on the back, one round plaited basket, also Malay; also some short Malay knives, one big cropping-knife, a long throwing lance, a tinder-box with steel, stone and tinder, half a cocoa-nut shell for drinking, and a small Malay bamboo box.

**H**OW I would have liked to take away with me all these objects! But this was not to be, for it was all they had in the world. They had need of everything that I would have collected. However, I will quite honestly confess that in spite of all my cupidity, another factor was playing its part: not only my companions, but I also, felt a horror in touching the stuff.

From these tools it is to be deduced that the Kubus obtain fire by striking steel against stone, a custom which was certainly adopted by them from the Malays. Fire, however, does not play an important part with these nomads, for not every animal is roasted; to warm oneself by the fire is hardly necessary in Sumatra; and smoking is not known to a genuine Kubu.

The Battaks on the island of Sumatra had been cannibals up to 20 years previous to my visit. In 1902 an old priest cult man with whom I was very chummy, had told me with saliva dribbling down his chin, how excellent his grandmother had tasted to him

when he made a hash of her a short while previous. But no trace of such a habit is to be found with the Kubus, and it may be assumed with certainty that it had never been the case with them.

Whoever knows the most of life of these two peoples will not be surprised at this. The Kubus are the best natured people imaginable on earth. They know neither falsehood nor theft, they do not go in for robberies and live only in small groups, up to 40 heads at the utmost, and without direct contact with their other tribesmen.

Depending on statements of the chiefs and *djenangs* of the various groups which I have visited I estimate all the Kubus living in the primeval forests of Djambi (a territory nearly as large as Switzerland) at about 2500 souls.

**T**HE dress with these primitive people consists only of the *tjawat*, bark beaten to a broad, soft material, which is drawn in lengths between the legs and wound around the loins.

As to their intellectual state in general, I can only say that my first impression from a visit to three different groups pointed decidedly in all three instances to the fact that here we had to do with people of an extremely low type, but after a lengthy conversation I always came to the conclusion that they are by no means unintelligent. Proof for this supposition is fully furnished by the Kubus who have been transplanted to Dutch settlements and who rapidly accommodate themselves to the mode of life forced upon them.

We have to do here with the best natured of creatures. According to our standards they are possessed of an absolutely inconceivable calmness and patience. The word time is totally

unknown to them. To questions concerning their age they are unable to give an answer, not even, as other primitive people say, "so and so many rice-crops," or as once an old Battak woman assured me, she was "seven smallpox-epidemics old."

On the two weapons which I found with them it is already clear that the Kubus are no warriors. Besides the simple throwing lance, about ten feet long, and the plain Malay cropping knife, which serves only for defence and for striking down wild animals, the Kubu has no weapon of defence or of offence. Bow and arrow are unknown on the whole island of Sumatra, and the blowpipe found with Battaks and the Sakeis in Malacca, who are so nearly related to the Kubus, has been looked for by me here in vain. Also the poisoning of the lances with *ipoh* or other vegetal or animal poison seems to be quite unknown to them.

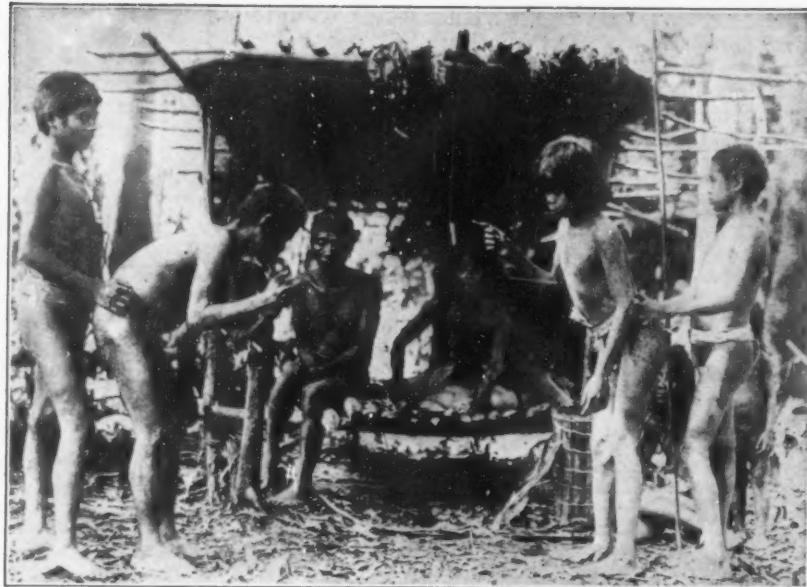
**F**ROM this it will be seen that the Kubu is an extremely peace-loving being. He is very reticent towards the intruder, which however does not mean to say that he is a coward. If the latter were the case, then he would not rest at night on his open sleeping-place without a guard and without a torch. The tale which frequently crops up, that these people "clamber into trees like monkeys" on the approach of strange people, I decidedly doubt. In such a case would they not also have dwellings in the trees, or at least a sort of observation-post?

About the customs and usages at pregnancy, birth, marriage and death very little is to be said. Before and after the birth the husband provides the food for the wife. The birth happens without any ceremony, the husband assists his wife, and when the



A KUBU INTERIOR AND EXTERIOR

*This may be taken as a Kubu version of home, sweet home. The padlocked box at the right belonged to the author. Two throwing lances, driven point down into the earth, show in the foreground*



A FAMILY GATHERING

*The mother and father are inside the house sitting on a divan. The children are engaged in a bit of interpretive dancing on the lawn in front of the residence. All primitive peoples love to dance*

new child of the primitive forest is born, he is not bathed or washed, but only cleaned with leaves or with fine ground bark. After some hours, certainly the following day, the mother gets up again and looks for her food as usual.

About names and naming I learned almost nothing, which, however, need not be wondered at for the same limited group of people live their whole life together and do not at all come into contact with the world outside. Even among themselves they are very short of words. Perhaps because the names are difficult to remember, the *djenangs* give Malay titles to the men. Thus I heard them talk about Lurah, Temunggung, Rio, and Adipati, at which they had to laugh themselves.

THE sort of relations that exist between parents and children, especially between the mother and her offspring, I was unable to find out. The whole group appeared to me as a single big family. Boys as well as girls go out into the forest themselves later and search for food.

When the time of maturity arrives, then there are no "long engagements," nor do they observe complicated marriage ceremonials. The young couple simply goes to its parents, declares to them that they now want to share together life's joys and sorrows, whereupon the girl is asked by her father whether this is really her wish. The affirmative "*tjah*" (yes) then concludes the whole formality. Monogamy is the general rule, but the man has the right to marry a second or several wives. There is therefore only marriage attachment out of love and affection. These primitive people merely

follow their natural instinct, and on the latter becoming extinct they separate again in most cases, and without formality. The children go with the mother or with the father, to whichever one they are the more attached. Not even this, however, is of much consequence, for the people do not go away, but all remain together.

IT is difficult from our European point of view to realize such extraordinarily strange conditions. Even for me much was strange, although I had lived fully 20 years among the Battaks. Everything, however, is so natural and simple, while the "man of culture" cannot imagine anything without cer-

tain laws, stipulations and formalities. When, then, we put questions to such primitive peoples, they are altogether unable to understand the purport of them, for such questions have no significance in their existence.

Life in the primeval forest has unspeakable hardships. The battle against everything that moves is bitterer than the outsider is able to imagine. A short stay with the Kubus, even on a rainless day, taught us enough of the plague of innumerable mosquitoes which are continually harassing these poor people; and many of them fall prey to hungry tigers or to the bite of snakes. A closer examination of their bodies is sufficient to show to what dangers these poor people are continuously exposed: apart from the skin disease already mentioned, many wounds, ulcers and scars show what they have to fear and to suffer through all their life. I was unable to get statements about malaria and dysentery, although I heard a child whine pitifully in a high fever.

WHETHER cholera had occurred with them I could not make out, but they seem to be scourged periodically by smallpox epidemics which rage terribly amongst them.

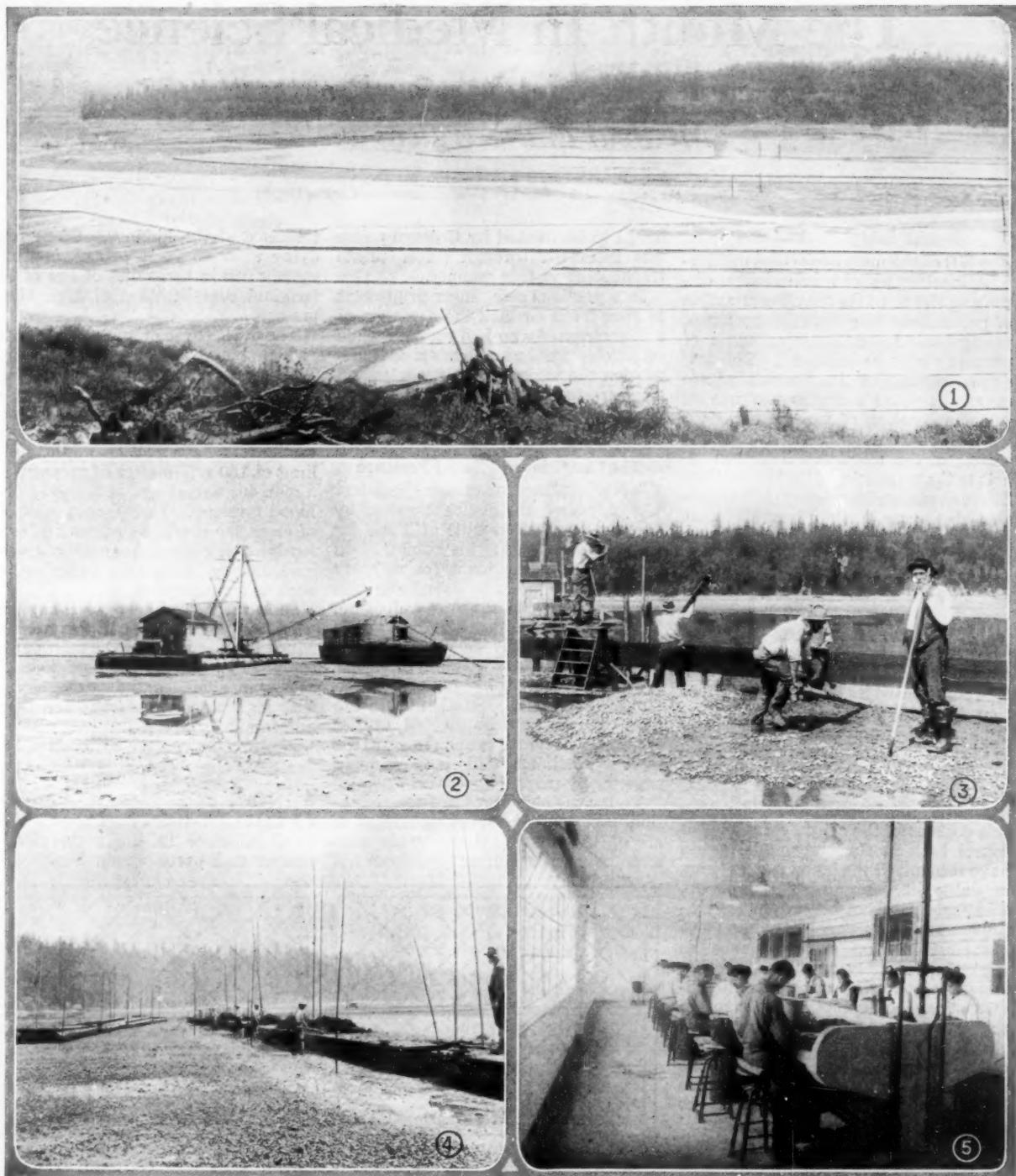
The chief of the tribe is asked, if somebody falls ill, to prepare curative herbs and roots. If no remedies are of avail, if help seems to be out of reach, the wretch is simply left to his fate. Without further care the whole tribe abandons him from fear of death. The Kubus know nothing about burying or burning the bodies of their dead, and places where somebody has died are shunned for a long time.

From all that has been said we may conclude with a sufficient amount of certainty, how low a stage of development these people have come to.



THE CHILDREN LOOK RATHER INTERESTING

*The social unit is the family but the lines of relationship are somewhat difficult to draw. The children mainly belong to the family as a whole. This is a common stage in the evolution of the family*



## Farming the "Beefsteak" Oyster

THE photographs on this page illustrate features of the "farms" in Puget Sound, Washington, where an oyster, so large that it is called the "beefsteak" oyster, is being cultivated. These bivalves mature in three years as compared to the four years necessary for growth of Atlantic oysters. The seeds, smaller than a pin-head, are all imported from Japan where they are gathered after they attach themselves to clean shells strung on wires that are lowered into the water. Last year over 12,000,000 of these seeds were imported by the growers. In growing

them, large areas of very shallow water are used. Since the tide would leave this land bare 18 times a month, dikes are built to retain enough water to protect the oysters from frost and predatory birds. Figure 1 shows the home of the "beefsteak" oyster. A bed in preparation is shown in Figure 2 where gravel is being spread from a barge. In Figure 3 a dike is being built, while Figure 4 shows the method of seeding and harvesting with small scows. The crop of oysters is removed to a central opening house, Figure 5, where they are opened for shipment.

# The Month In Medical Science

## *A Review and Commentary on Progress in the Medical and Surgical Field*

By MORRIS FISHBEIN, M. D.

*Editor of the Journal of the American Medical Association and of Hygeia*

### Determining Fatherhood

ONE of the most important medico-legal questions constantly disturbing the courts is the determination of parenthood in cases of importance, particularly where large amounts of property may be involved. The evidence assembled in various places in recent years concerns the use of the phenomenon of iso-agglutination; namely, the manner in which the fluid matter of the blood of one person reacts to the corpuscles of that of another. These investigations indicate that it is possible to say in some instances that a certain man could not have been the father of a certain child, although it is not possible to say definitely that a certain man is the father of a certain child.

One of the highest courts in Prussia has even refused to accept the blood test as supporting the first conclusion. The court based its decision on the fact that in 1926, 2000 children were examined and that there was one child in the 2000 about whom it could not be said positively that a certain man was not the father. The Medico-Legal Society of Berlin took action condemning this decision of the court. Many lower courts both in Germany and Austria have recognized the blood test as being of value in determining fatherhood. The Society did not believe that doubtfulness in one instance should serve to cast discredit on such evidence as might be definitely developed in other instances, pointing out that all evidence may be susceptible to error to this extent.

It seems likely that most of the courts of the world will be willing to accept the evidence afforded by the blood test when the reactions are definite, of course, taking this material in relationship to all of the other material that may be available.

### Finger Prints by Wireless

THE finger print, foot print and even the nose print represents means of personal identification which are not susceptible of modification and which are perhaps the only means of personal identification that are certain. It is important to know therefore that the police of London have recently used a new system by which finger prints can be sent by means of wireless to all parts of the world. A person detained by them and be-

lieved to be wanted by Chicago police was identified through finger prints transmitted in this manner.

In a previous case, finger prints sent to New York enabled the detection of a counterfeiter who had escaped while on parole. In the new system of transmission the various whorls, circles and loops are described by index letters and figures, and can be reconstructed at the place of receipt in a few minutes.

### The Centenary of Blood Pressure

ONE hundred years ago there first appeared the device invented by Léonard-Marie Poiseuille of Paris for measuring accurately the human blood pressure. This device is the mercury manometer familiar to every one who has had a life insurance examination. The device used today differs but little from that originally developed by the French investigator. It has been improved, of course, by modern manufacturing methods. Substitutes in the form of spring devices are used, but for extremely accurate measurements, the mercury column still is considered superior by many physicians.

Today the blood pressure determination is perhaps the most significant of all of the investigations made preliminary to ascertaining whether or not

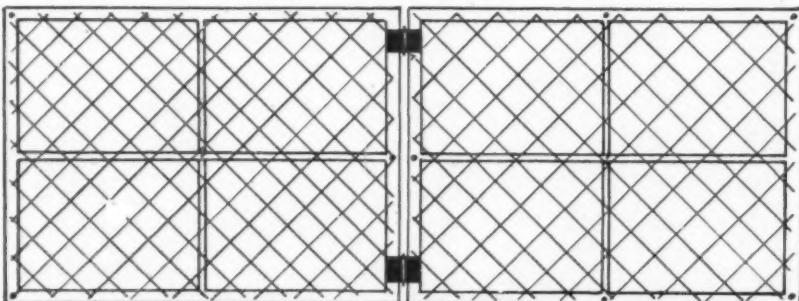
turbance of the kidneys. Of persons dying after 45 years of age, approximately one in three dies of one of the terminal complications of high blood pressure.

The exact cause of many of the cases of high blood pressure is not known. The pressure may be influenced by disturbances of the glands, by diseases of the heart, or of the kidneys, and by changes in the blood vessel walls. Investigators have set an approximate limit of 150 millimeters of pressure for a man 40 years of age as a sign of high blood pressure. In the vast majority of cases the condition comes on insidiously, being most frequently discovered during a routine examination, such as for insurance.

Men are more likely to be troubled with the condition than are women. Much has been said of the relationship of heredity to the disease, and the available evidence indicates strongly that high blood pressure is hereditary and familial.

### Window for Transmitting Ultra-Violet Rays

SINCE it has become well established that ultra-violet rays have a beneficial influence in the prevention of rickets and probably on health gen-



WINDOW FOR TRANSMITTING ULTRA-VIOLET RAYS

Windows such as this one can be made and used in the home. It consists merely of a light wooden, hinged frame and a layer of Cellophane sandwiched in between layers of chicken wire

an applicant is a fit subject for insurance at the ordinary rates. The human blood pressure should be approximately 120 at 20 years of age, and it is customary to add 2 millimeters for every five years up to the age of 60 years, so that the average at 60 is 135. During 1924, one in five of the persons who died in the United States died as a result of one of the complications of high blood pressure, heart failure, hemorrhage into the brain, or dis-

erally, special types of window glass have been created to permit the transmission of these rays from the sun.

Dr. A. H. Pfund has described a method of preparing a window for use particularly for a sleeping porch or bedroom, reasonable in price and generally useful. A light wooden frame is prepared and covered with coarse chicken wire. The substance called Cellophane, which permits the transmission of the ultra-violet rays, is then laid over the

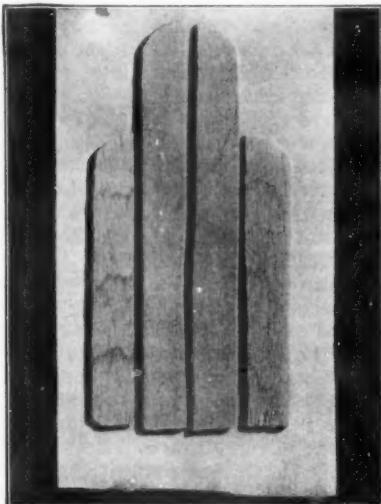
chicken wire and one layer of chicken wire placed over it. Screws serve to hold the "sandwich" together. Such a window permits full transmission of the ultra-violet rays and loses but little in its transmission powers after having been exposed to sunlight for a year. The materials are cheap and the entire window can be prepared at a cost well under a dollar.

#### Eye Injuries by Air Guns

**I**NJURIES to the eyes by the indiscriminate use of air guns and sling shots are so frequent as to have made necessary a special report by Doctors F. H. Rodin and Albert B. McKee. In three cases described by them, BB shots and a staple thrown by a sling shot passed into the eyes, resulting in serious inflammations and requiring surgical removal. In many instances, if the foreign body is not infected, it may lie in the eye for weeks and become encapsulated so that no action is taken until sight is suddenly lost due to the formation of a scar or to interference by the foreign body with vision. In one case, the BB shot was spontaneously forced out of the eye 16 days after it entered; in another case it lay in the eye for two months before it was necessary to take any action. Modern methods, involving the use of the X ray, permit exact localization of the foreign body and make its removal much simpler.

#### A Splint for a Broken Thumb

**F**RACURES and dislocations of the thumb are not infrequent, particularly as they occur in association with sporting events, such as base-



STRUCTURE OF SPLINT

*Four pieces of tongue depressors, cut and shaped as shown, serve as the rigid support*

ball and boxing. It is frequently necessary to hold the thumb in a correct position for long periods of time in order to secure proper healing. Plaster of Paris is useful for the purpose but

requires time to put on and is bulky and uncomfortable for the patient. Dr. Charles W. Lester has invented a combination of tongue depressors and adhesive plaster which makes an exceedingly useful splint, easily removable, comfortable to wear and satisfactory for the purpose.

This splint is made by pasting on the adhesive plaster four strips of tongue depressors, varying in length so as to control the short and long sides of the thumb. Plaster is cut so that it fits easily without wrinkling when the device is fitted over the thumb. It is held in place by three narrow strips of adhesive.

#### The Dirty Shirt

**T**HE sanitarians have found that repeated washing with soap and water and drying in the sun constitute perhaps the best method that we have for eliminating infection on a large scale.

Recently, Gladys P. Winegar of the University of Nebraska, determined to find out how many bacteria accumulated on underwear worn for a long period without washing. After the underwear was worn one day, the average count of bacteria per square inch was 400,000. If the shirt was worn six days consecutively without washing, the number increased to nearly 10,000,000 bacteria per square inch. When the shirt was laundered and then dried, the number of bacteria was reduced to 1,000 per square inch or less. The washing alone was effective, but much better results were accomplished by drying thoroughly and particularly by drying in the sun.

The germs found were those usually found on the skin, particularly the pus-forming organisms that are associated with pimples and similar skin infections. More and more underwear is being eliminated from the modern feminine costume and the one-piece dress is worn with but a minimum of clothing beneath. This top dress is not washed or cleaned daily; in fact, not even weekly or monthly. Yet for the most part it is the garment which comes into constant contact with the skin of the shoulders and the upper portion of the chest. The increasing amount of minor infections of the skin of these regions may be associated with this constant contact of heavily germ laden wearing apparel with the skin in the regions concerned.

#### More Reducing Creams

**T**HE craze for slender beauty is apparently still sufficient to encourage promoters in continuing to issue inefficient combinations of ordinary substances with exaggerated claims as to their ability to remove superfluous flesh. One of the concoctions most recently promoted under the name of "Nature's Way Reducing

Cream" consisted simply of a mineral oil, wax, Epsom salts, baking soda and alum. The woman with abnormal breasts, large hips, or heavy thighs was urged to reduce these portions of her anatomy by rubbing on the mixture. The promoters were enabled to get it on sale even in large department stores and many women paid as much



SPLINT IN PLACE

*The wooden strips shown below are held in place on the thumb by adhesive plaster*

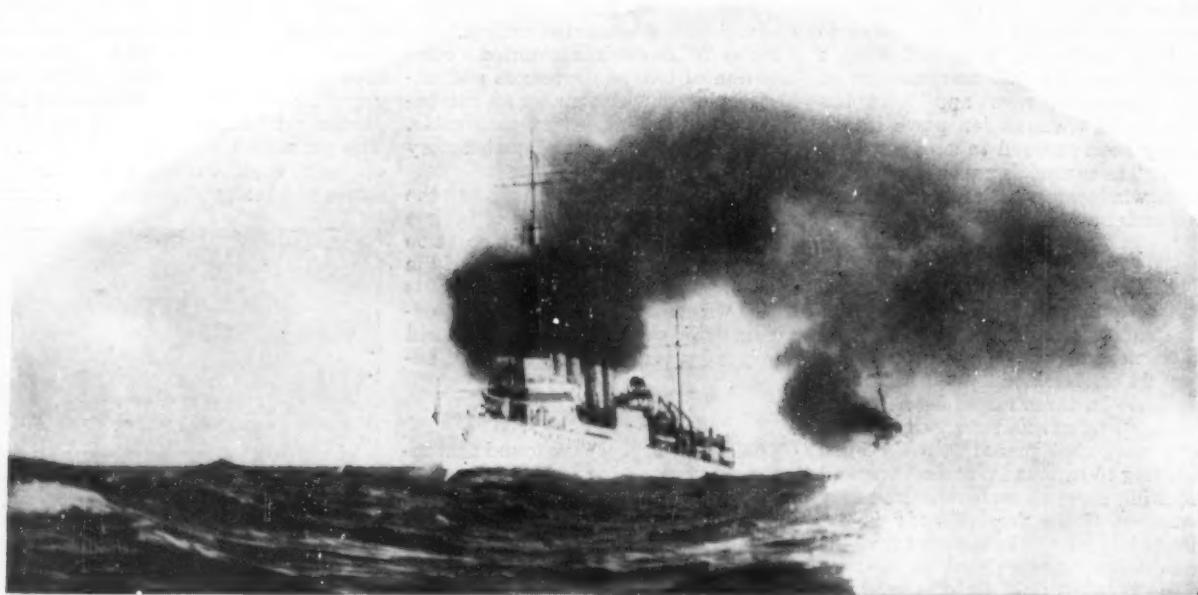
as 15 dollars for a few ounces of this concoction. It is obviously preposterous that the rubbing in of such a mixture would reduce any portion of the body.

There is one sure way to take off fat safely, and that is to reduce the diet and to take enough exercise to use up the calories that are taken in.

#### Vitamins in Clams and Oysters

**P**HYSICIANS and dieticians are constantly searching for foods containing vitamins, since these substances are so important for life and since the average human being likes a varied dietary. It is now shown that oysters and clams contain not only protein and sugar, but are comparatively rich in their vitamin content. They vary, however, in this regard. The oysters are rich in vitamin B, but neither the hard nor soft clams contain it in appreciable quantities. Vitamin A is also found in oysters in larger concentration than in clams. The clams, on the other hand, contain more vitamin D than do the oysters, but the oysters contain more vitamin C. Both the oyster and the clam are valuable as parts of a well balanced diet and furnish plenty of justification for adding shellfish, even were it not for the fact that most people like them.

The fact that oil of the cod's liver is the richest of all food substances in vitamin D would seem to be a sufficient suggestion that similar properties can be expected in other marine animals.



FULL SPEED AHEAD IN FORMATION

*Destroyers maneuvering at full speed. The wake of the leading destroyer may be seen in the right foreground. These ships are capable of high speed, yet are sea-worthy enough to remain with the fleet at sea. Each of these carries a number of torpedoes and has appreciable gun-power.*

## Naval Adequacy—II

*Ships in a Wide Variety of Types and Classes Are Needed  
By a Navy to Perform Numerous Duties  
During War or Peace-time*

By CAPTAIN N. H. GOSS, U.S.N.

THE second element of sea power to be considered at length is the subject of ships.

The discussion of naval bases naturally came first because the types of vessels, the classes of each type, and the relative numbers of each necessary to form an effective navy, depend so largely, as we have seen, upon naval bases.

"Fleet" is an inclusive term because it includes ships of many different general characteristics, known under the classification of "types," which are necessary to meet the various needs for sea or air-borne craft. But, within the limits of types, there are also some differences in size, speed, and gun-power which are commonly referred to by the term "classes." Naval architecture being, like most other things, in process of gradual evolution, progressive improvements are naturally embodied in succeeding classes, so that the better examples of each type are nominally found in the later classes.

While natural evolution, as noted, brings about successive improvements in the class or type of naval craft, invention and discovery also introduce new types as new weapons or new

means of defense are developed. As an example of this, a new type, adapted for steam propulsion, succeeded the sailing vessels of the sailing era; the monitor type, mounting its guns in revolving turrets so that they were useful in all directions instead of simply as one broadside, was evolved during the Civil War. Later the small, high-speed type was developed to carry the newly-invented, self-propelled torpedo; a somewhat larger, faster type, called the torpedo-boat destroyer, was developed to combat this; and so on.

OTHER examples of development were the introduction of the submarine type; the utilization of aircraft for naval purposes, including ships to carry aircraft; and, in our navy particularly, repair ships and tenders that have been developed to make our vessels more self-supporting while away from the navy yards and to offset, in some degree, our lack of well located naval bases.

Thus a modern fleet consists of a multiplicity of types, such as capital ships—comprising battle-ships and battle cruisers—cruisers, destroyers, submarines, airplane carriers, tenders,

repair ships, hospital ships, mine planters, and various auxiliary types such as passenger liners for use as transports, oil tankers, cargo ships, tugs, and mine sweepers. A fleet is not effective or efficient in a modern sense unless it comprises all these types, because each has its special purpose which no other type of vessel can fulfill.

The backbone of a fleet is the capital ship, not only because it has the greatest fighting power of any type of vessel, but also because it alone has effective defensive or resisting strength. It carries guns of the largest size in its battery. This type also is the only one large enough to permit the great amount of sub-division into compartments necessary for under-water protection; to carry side and deck armor of sufficient thickness to withstand the penetrating effect of modern shell and the explosive effect of the modern bomb; and, in addition, to have space to carry the machinery necessary to propel the ship at sufficiently high speeds.

The modern capital ship has all these qualities. It carries turret guns of heaviest caliber capable of firing projectiles that can penetrate armor at

ranges in excess of 20,000 yards—far beyond the horizon and out of sight of a man on deck. It carries in its magazines enough ammunition for these turrets to keep up an engagement lasting for hours at a time. Its underwater, side, and deck protection enable it to lie in the line of battle throughout an engagement and resist all forms of attack. This latter point is extremely important—and particularly so for us whose ships must operate for long periods and at long distances away from bases. The capital ship is the only type large enough to be given sufficient protection to withstand the attacks of modern guns, air bombs, mines, and torpedoes, and yet remain in the line of battle and continue to fire its own guns.

No other type has the size to afford this protection or to undergo the compromise of space necessary in any man-of-war, since no ship can disregard any of these factors and still be efficient. If too much space is given to protection, the result will be low speed; if too much attention is given to gun-power, the ship will lack protection; and if too much consideration is given to speed, it will certainly lack protection as well as gun-power, unless of super-size.

**A**LL naval vessels must necessarily represent some compromise, but the capital ship is the only one that is large enough to allot sufficient tonnage to each of these necessary factors. As mines, torpedoes, and aircraft became more effective, capital ships had to be made larger to accommodate the necessary defensive features. An example of too much compromise in favor of one of the desired qualities was shown in the disaster to the British battle cruisers at Jutland, where protection had been sacrificed to gain speed with the result that their magazines lacked the necessary protection. A battle-ship of a late type which was better protected, successfully resisted a concentrated fire of the heaviest guns. This was the *Warspite* of the "Queen Elizabeth" class.

Battle-ships on each side successfully withstood torpedo hits at Jutland without slowing down or leaving the battle line. Newer capital ships, however, have much more efficient under-water protection while the older ones have had torpedo bulges fitted to increase their under-water resisting power. Furthermore, all capital ships now have effective deck protection against bombs.

Capital ships are divided into two types: battle-ships and battle cruisers. While each is of the largest size, the former type is fitted with maximum protection and a greater number of heavy guns. Consequently it is somewhat the slower. In order to embody at least under-water protection and the highest speed, the battle cruiser type, which should normally be the larger of

the two, has somewhat less gun-power and slightly less armor protection. In the World War, the German battle cruisers fared better than the British, because they had better protection for their magazines and a more complex watertight subdivision. The subdivision was so good, in fact, that one German battle cruiser reached port after the Jutland battle with more than 7000 tons of water aboard.

**AIRCRAFT** carriers are one of the modern types of vessel. The fact that all kinds of aircraft have a limited operating radius and are dependent upon frequent return to some base, necessitated the development of a type of ship that would house aircraft crews and furnish fuel and supplies. They also carry land planes as well, since seaplanes are slower than the land type, harder to maneuver and, even though catapulted, cannot always land safely or conveniently upon water.

The modern plane carrier is equipped with what amounts to a fair sized landing field. All carriers are inherently vulnerable above water inasmuch as shell fire or even light air bombs would damage their landing deck; but it is desirable, and at the same time possible, for them to have adequate under-water protection against mines, torpedoes, and the minning effect of bombs dropped alongside. These plane carriers should have as high speed as is practicable since they must accompany the fleet at sea. It is desirable, to facilitate attack, defense, or raiding operations, that they have very high speed.

Modern plane carriers carry large numbers of planes—easily more than 50 and some as many as 75—and are

self-contained and quite complete floating airports. Not only is the landing deck a flying field, but each carrier contains repair and overhaul shops, quarters for personnel, fuel and bombs for the planes, and all the necessary hoisting apparatus for seaplanes as well as land machines. If the carrier be large, such as are those of Japan and our new ones, it is feasible for them to have high sea speed and very complete under-water protection.

The present cruiser type is the modern development of the frigate of Nelson's day. Those who have read naval history will remember Nelson's constant cry for more frigates to enable him to search for the enemy fleet and keep up his communications. While radio has eliminated the despatch-bearing requirement of the former day, cruisers are still just as indispensable for communication duties, since they carry the longest range radio and are otherwise adapted to the performance of modern observation duties. In a fleet, each type naturally has its own particular duties, but those falling to cruisers are varied as well.

**W**HEN the fleet is cruising, cruisers are necessary to form the main units of the screen—either an offensive screen operating at long distances, or the protective screen operating at moderate distances. Since protection is necessary in more than one direction, considerable numbers of cruisers are required for this purpose.

Cruisers are necessary also for fleet communication duties, it being necessary for them to serve as both radio and visual-linking vessels to enable the commander-in-chief to maintain contact with the various units comprising



GUANTANAMO BAY, CUBA

All types of modern ships of war are represented in this United States Navy group at anchor. Here may be seen capital ships, cruisers, destroyers, submarines, tenders, plane carriers, et cetera.

the fleet. When the fleet is deployed in battle formation, cruisers have again a special rôle to play: that of supporting the attacks of our own destroyers, while at the same time protecting the battle line from the attacks of enemy destroyers. Here, again, numerous cruisers are needed because, if the development of the action involves large changes or reversals of course, there is not time for the light forces ahead to change their position and gain their new stations; therefore there must be a force also operating along the normal rear of the formation.

An example of modern cruiser efficiency was the work, at Jutland, of the Second Light Cruiser Squadron under Beatty, in developing the first contact and, later, in discovering and reporting the presence of the German High Seas Fleet. An example of the lack of effective modern cruisers was the failure of the Grand Fleet under Jellico to make timely contact with Beatty after Jellico's thin screen of old cruisers had been thrown away from his front by his successive changes of course to the right.

**C**RUISERS are the normal counter against destroyer attacks, for, if enemy destroyers are permitted to arrive within torpedo range of the battle fleet, the destroyers' torpedoes will cause the heavy ships to maneuver at least and this, in turn, breaks up their fire, the resultant advantage going to the enemy side. On the other hand, if cruisers in sufficient strength are present, enemy destroyers are attacked by these while they are still beyond torpedo range. Such modern cruisers have not only speed approaching that of a destroyer, but also have sea-keeping qualities that, in normal seas, enable them to maintain their speed when destroyers are obliged to slow down.

Light cruisers have other duties as well. While large enough to keep the seas in all weather, they have considerable gun-power and long cruising radius; hence they are well adapted to convoy duty. Since a nation that is deficient in naval bases must employ many of these convoys, fuel ships, and supply ships over long distances, considerable numbers of these cruisers are necessary to safeguard them from enemy attacks enroute.

By their high speed, long operating radius, and good sea-keeping qualities, cruisers are also well adapted to reconnoitering and raiding duties, and are especially necessary if battle cruisers are not available for this work.

To attain the high speed necessary, cruisers have to be fairly large and, since so much space must be devoted to machinery, they are correspondingly lacking in protection and are very vulnerable, although large and conspicuous targets. Here, again, the numbers of this type are predetermined somewhat by the number and kind of naval bases owned; and the nation lacking these needs cruisers in numbers to offset inevitable damages and losses.

The first torpedoes were carried on a spar attached to a picket launch; as such they were successfully employed in the Civil War, a notable example being the sinking of the Confederate

tremendously vulnerable. Since they are so vulnerable that an attack *en masse* is necessary, they have to be very numerous in order to be effective. They are a potent weapon, however, because the great numbers of torpedoes that may be loosed in a concentrated destroyer attack is a constant threat. The German destroyers, for example, caused Jellico to turn away frequently at Jutland and enabled the German fleet to escape from his overwhelming gun-fire.

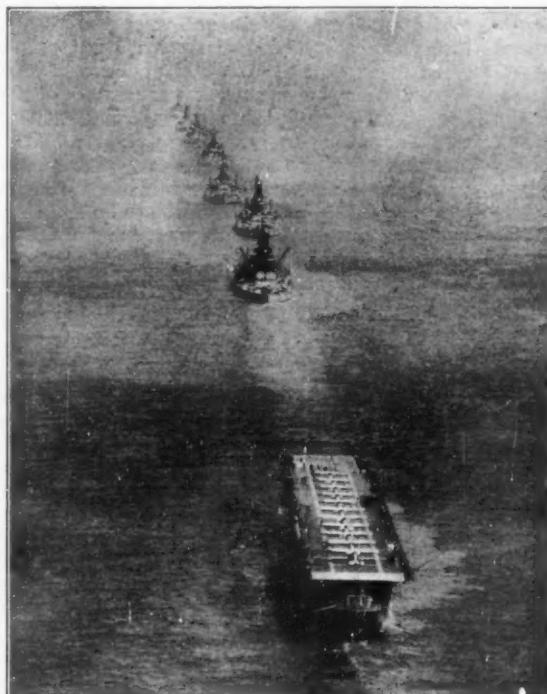
The late war developed another highly important use for the destroyer as an anti-submarine weapon. Being large enough to keep the sea, particularly with slowly moving convoys, and large enough to carry a considerable

number of depth charges, (our destroyers in the European war zone during the latter part of the war, carried as high as 50), the destroyer has proved to be the most effective weapon against the submarine yet devised. It is also useful in rescuing crews of disabled vessels or troops from transports, more than 800 survivors having been rescued at numerous times by single destroyers.

**I**N modern war, destroyers are necessary to serve as an anti-submarine screen with the heavy ships of the battle fleet, to attack and drive enemy submarines below the surface. Since destroyers are very uncomfortable at sea, carry only a limited food supply, and have only limited high-speed radius, they are absolutely dependent on harbors that are at least sheltered and in which they may re-fuel, take on food supplies, and where their crews may have recreation.

War experience revealed the necessity of a somewhat larger vessel to work with destroyers, since a destroyer alone is not large enough to carry the necessary staff or signaling and radio equipment, or steady enough to facilitate necessary observations for torpedo control. The "destroyer leader" type was developed to meet this need. This is a high-speed vessel around 2000 tons, carrying the same torpedo equipment as the ordinary destroyer and having somewhat greater gun-power.

Submarines are also, of course, a comparatively modern type. In fact, there are now really two types of this vessel. One of these, around a thousand tons or smaller, has limited surface speed but is suitable for defensive purposes off the coast or for operating from a base in an island possession. Submarines of this type have comparatively small crews, carry substantial torpedo equipment, and, for their size,



PASSING IN REVIEW

Air view of the fleet steaming out of Hampton Roads, Virginia, passing in review before the President of the United States

ram Albemarle by Flusser. As the automobile torpedo developed, small vessels of high speed for the day, called torpedo boats, were developed. This was the type in use during the Spanish-American War. Their small size, however, made them unsuitable for use at sea. The modern torpedo vessel is a development of the larger torpedo boat destroyers which were originally designed to combat these small torpedo vessels.

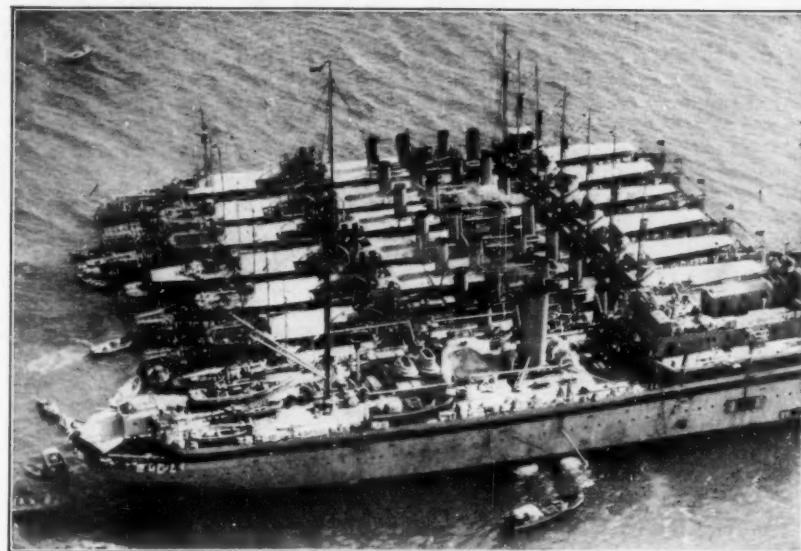
Modern destroyers are vessels having the highest speed, yet which are large enough to remain with the fleet at sea, and to be fairly seaworthy. They carry a considerable number of torpedoes—often as many as 12—and have appreciable gun-power. As they have even more machinery, comparatively, than cruisers, they are ex-

have excellent maneuvering ability.

The other type of submarine is a larger and more seaworthy vessel, having considerably higher surface speed and more gun-power, which is called the "fleet" submarine. This type is designed to accompany the fleet at sea and operate with it. Hence it is more self-sustaining than the smaller type. But, since all submarines have very low submerged speed; since the above-water hull of even a fleet submarine is not well adapted for cruising in anything like heavy seas; and further, since the larger type is desired to operate at considerable distances ahead of the fleet—hence is thrown out of position by material changes of course—even these vessels have to be in considerable numbers to be of great value in a practical sense.

**W**HILE submarines received a great deal of public attention during the World War, their use, and hence the attention they received, was so focused on attacks on merchant vessels that their potential value as a part of the combatant fleet was not greatly considered. Submarines actually possess one extremely important military characteristic that belongs to no other type of craft, for, practically speaking, they cannot be driven in or driven away; hence they are extremely valuable on reconnaissance or observation duty. Actually, while the public did not hear much about it, both the Allies and the Germans used them for this during the World War. They would be much more valuable, even, for uses of this nature away from restricted areas such as obtain off the German and British coasts.

It would be hard, in fact, to exagger-



A MODERN TENDER

*Each destroyer squadron of 19 vessels is based on a tender which carries supplies and makes minor repairs. This enables destroyers to cruise with the fleet and remain away from home ports*

ate the military value of the modern submarine. It can now operate at long distances from home and can remain at sea; it, alone, of all craft, is invisible; it is independent of gravity; and it possesses all the advantages in the game of hide and seek, for it can observe its enemies long before they have any chance to observe it, can quietly drop below the surface until the danger is past, and can then come up and go about its business.

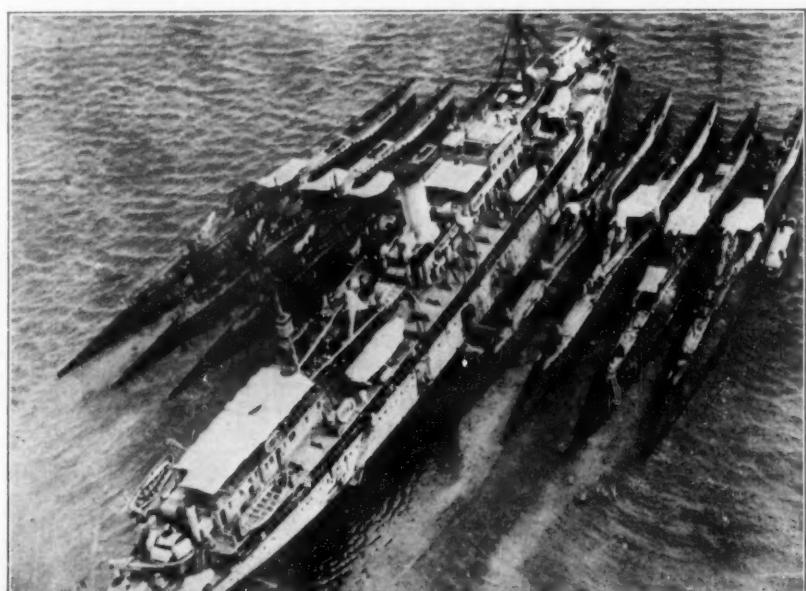
Since, however, all submarines have low submerged speed and low surface speed in heavy weather—even the larger type—and, as all submarines are vulnerable, they are effective only in numbers. Due to the low relative

speed of submarines and to the fact that even the large ones are very uncomfortable, a country having abundant bases and harbors has an inherent advantage which a larger number of enemy submarines would find difficult to overcome.

Mine-laying vessels are very essential in modern warfare, since mines play an important rôle in the actual damage they inflict, in the hampering effect they have on fleets' movements, and in the constant threat they exercise in the shallow water off a port and in comparatively deep channels as well. Fortunately, small and fairly fast merchant vessels are readily adapted to mine-laying duty and a fleet, in time of peace, does not need many specially constructed vessels of this type, it being necessary to have only enough to provide a skeleton organization of trained personnel for this duty.

**S**INCE destroyers and submarines have not the stowage space to carry any considerable amount of stores and provisions and can carry only repair equipment of the most limited nature, the "tender" type has been developed to supply these needs. Tenders are really vessels of merchant type equipped to carry the stores and fresh provisions which these small vessels require, and also considerable machine shop and repair equipment. A pontoon equipment makes possible the shifting of propellers without docking. This goes a long way toward solving the problem of maintaining these vessels while they are away from home yards.

Repair ships are also vessels of merchant type. They are equipped with small foundries, blacksmith shops, and machine shops for making minor repairs on other vessels away from navy



A PORTABLE SUBMARINE BASE

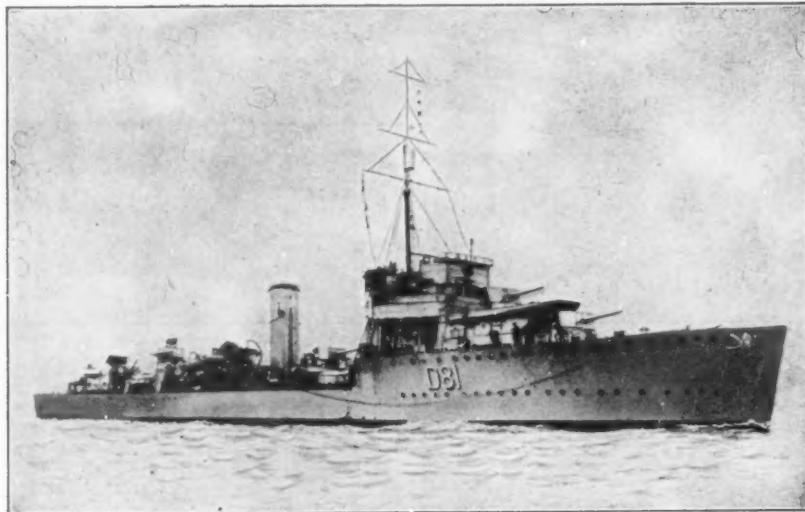
*A submarine tender, like the U. S. S. Beaver illustrated here with a division of submarines, makes it possible for these vessels to operate away from a fixed shore base for long periods*

yards. The value of this kind of equipment was clearly demonstrated during the World War when all our destroyers in the European war zone were based on such tenders. These vessels not only enable the destroyers and submarines to cruise with the fleet but effect a considerable money saving on repairs that are made in peace time, since

the target. In fact, navies are in no wise limited even to carriers or shore bases, for all sizeable vessels—all the combatant types, in fact, above destroyers in size—now carry airplanes. To enable ships to do this, our navy pioneered in the development of the catapult which is capable of launching a plane after a run of only about 60

modities. An extensive merchant marine is particularly necessary to a country without amply provided naval bases in its insular possessions or along its lines of communication. Even to sustain a fleet in an overseas expedition requires literally hundreds of vessels of merchant type. In an expedition involving troops, many fast vessels of the passenger liner type are required as troop transports. Obviously, as it would be too expensive to build and maintain such vessels for naval use only, a naval power is dependent on a merchant marine; and the country possessing a large and efficient fleet of this nature, has a tremendous advantage over one that lacks it.

Thus our discussion of "naval strength in terms of ships," shows that a well-balanced, adequate navy consists of many types of craft, all of which have been developed as the result of experience. A fleet would not be complete nor could it exert its full strength with any of these types lacking. But two types that have continued in use are the capital ship and the cruiser. New weapons have brought changes in their characteristics but the type still persists because the same need continues for a fighting vessel that can take, as well as give, the heaviest blows, and for a reliable and swift vessel to maintain communications. The capital ship has had to be protected successively against under-water attack and air attack. Modern examples of such protection are: greater subdivision, bulges, and deck armor.



**AN EXTREMELY IMPORTANT TYPE WE LACK**

*A British destroyer leader. These ships have great maneuverability and can accommodate the extensive signaling equipment necessary, and the commanding officer of a flotilla and his staff*

all the work is done by enlisted men.

Aircraft are also properly incorporated in the general discussion of vessels. The principal naval powers and particularly the United States, it so happens, early recognized the great potential value of this type of craft; and naval officers were among the pioneer pilots trained by the Wrights and by Curtiss. Previous to this, one officer who became famous as a pilot—the late Commander Rogers—went aloft from our cruisers in man-lifting kites, the very earliest development of naval aviation. The United States Navy was naturally interested from the first in the development of the seaplane and, in fact, sponsored its development. As before noted, however, seaplanes of the larger, or flying boat, classes, while of long radius and of ample size for personnel requirements, are too unwieldy for many purposes; hence the navy is concerned also with the use and development of planes of the land type. Thus we find that modern aircraft carriers are designed and built to carry planes of all types except the very heaviest bombers, these being operated by navies from their air stations ashore.

**P**LANNES, aside from these normal uses, are particularly necessary and valuable for many special naval purposes. In addition to bombs, they are employed to carry torpedoes that are to be dropped within torpedo range of

feet. This enables cruisers and capital ships to carry their own planes for a highly important modern use, namely, to observe or, as it is called, "spot" gun-fire. This use which has been developed in practice by naval officers, especially in our navy, has the effect of greatly extending the range of heavy guns.

As everyone knows, the dip of the sea horizon limits the visibility from ships even from the fire-control platforms which are about 120 feet above the water. This formerly limited the effective range to less than 20,000 yards. By means of aircraft however, gun-fire may be controlled for much greater distances than this and, due to the height at which planes operate, the fall of projectiles may be observed even more accurately than from aboard ship at materially shorter ranges. It is easy to see the great importance of this developed use of aircraft, since it so materially extends the range of naval guns. Navies now employ the high-speed fighter type of plane as well to protect their spotting, observation, or bombing planes, the large carriers being well adapted to carrying this type of plane.

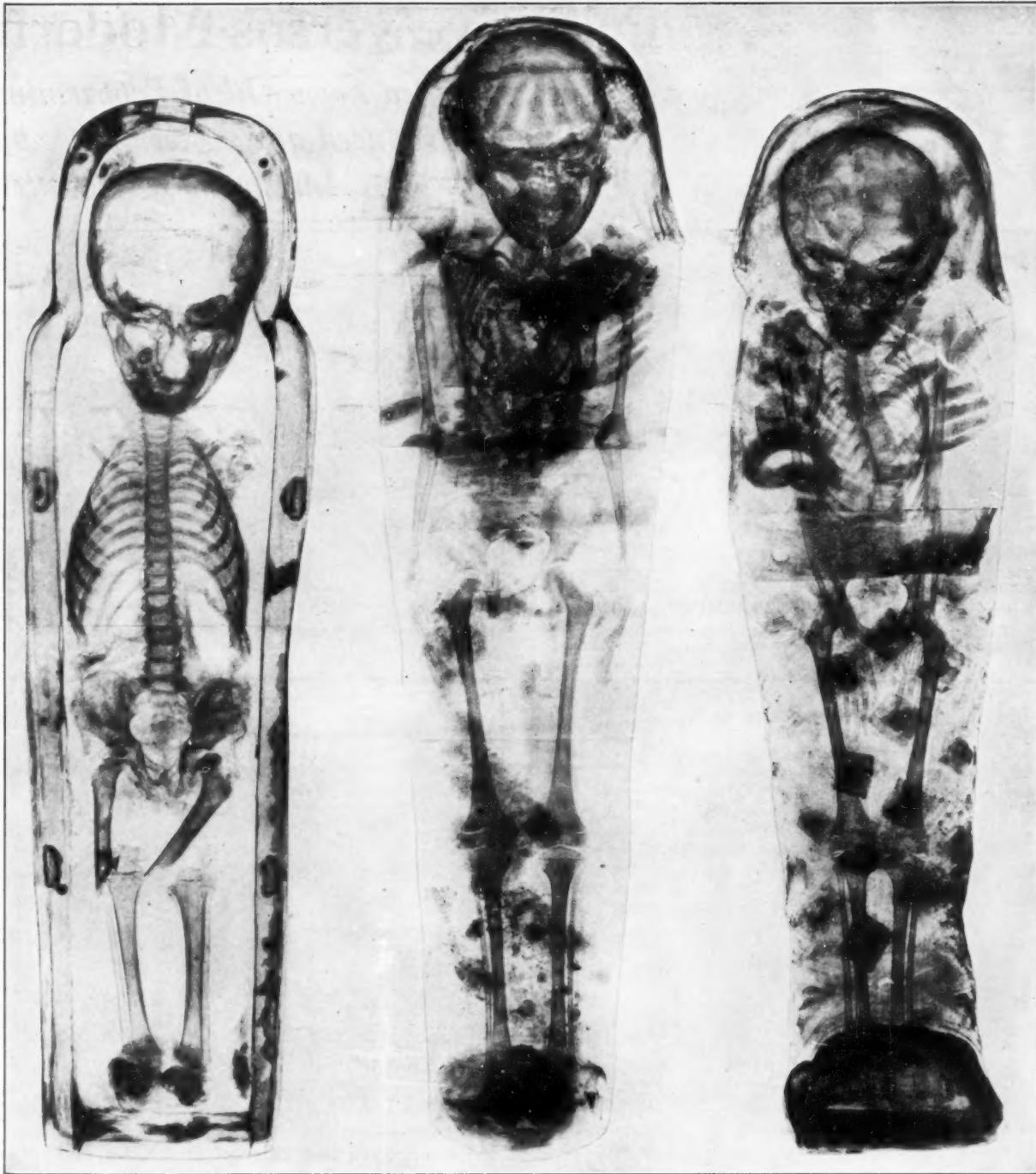
Merchant vessels compose a highly important part of naval strength and resultant sea power—an indispensable part to any country having overseas possessions that are not self-sustaining, and to any country dependent on imports of food, fuel, or essential com-

**M**ODERN fleets are more complicated than ever before but that is all, for the basic elements remain. New devices and new methods are employed, but the fundamental principles remain the same. The arbiter of victory is still the heavy turret gun, the only weapon that can plant its projectile, now weighing over a ton and carrying hundreds of pounds of high explosives, into the vitals of a ship. It alone can penetrate any armor and protection yet devised. It can not only do this at distances far beyond the horizon, but can repeat it hundreds of times without replenishment of magazines or return of the ship to port.

Scouting and screening and communications are now extended by the airplane and by the radio and the submarine, but more, rather than less, cruisers are required to co-ordinate and support these modern measures, for the areas to be covered are now so extensive.

So we see how naval strength is dependent upon a multiplicity of types of ships all dependent on each other.

**C**aptain Goss' third article, dealing with the subject of comparative naval strength, will be published in the November issue. Watch for it.



Photos Courtesy of Field Museum of Natural History

## X-Rays Reveal Diseases of Ancient Egyptians

THERE is a fairly widespread belief that the human frame is subject to many more ills in modern days than it was in the "good old times" before over-civilization became a "menace" to it. We are rather inclined to be surprised, therefore, when we discover tangible evidence that many of the same ills that beset us today also beset our earliest ancestors. There is perfect evidence, for example, that the owner of the famous Rhodesian skull of primitive man suffered severely from abscesses and toothache. Professor G. Elliot Smith, the noted British anatomist, has brought to light in early Egyptian mummies the evidence of many modern forms of disease. And

now, from the great Field Museum of Natural History in Chicago, come three remarkable pictures of Egyptian mummies of children whose skeletons, studied by means of new X-ray apparatus installed for that purpose, exhibit pathological peculiarities. The studies were made by Dr. Cora A. Matthews of Cook County Hospital.

The two mummies at the right exhibit curvature of the spine, a condition due to incorrect sitting posture. School health authorities continually combat the same evil today.

The mummy on the left is that of a baby whose bones show evidence of rickets, due without doubt to malnutrition.

# Primitive versus Modern

*Menthol, Distilled From Oil of Peppermint  
Is Produced at a Lower Price by  
Americans With Better*



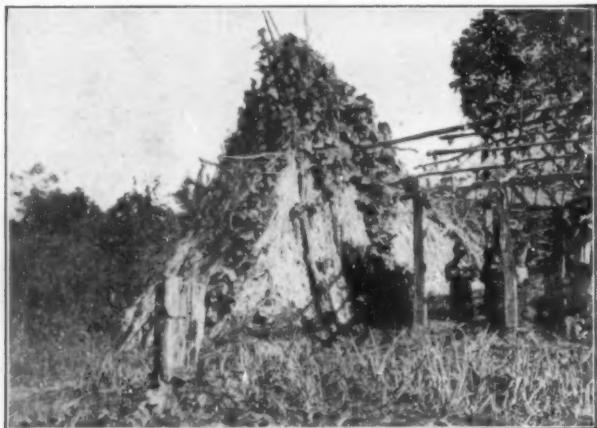
JAPANESE PEPPERMINT

The peppermint plant grown in Japan is much slenderer than the sturdy herb of the same variety that is now being grown in America



MINT DRYING RACK

In Japan, mint dries on such racks for weeks; in California, it is ground-cured in 36 hours, and gathered in the morning while wet



CRUDE STILL

Dried vines are used as fuel in this Japanese still. The mint farmer must stay on the job continuously to keep the hay-fire from going out



HARVESTERS

One farm hand in America makes more than this entire group of Japanese mint harvesters. Low wages favor the Japanese employer

THE Japanese mint farmer, with manual labor and crude apparatus, can produce menthol at a lower cost than American growers who have apparently everything in their favor—greater yields per acre, the most modern labor-saving machinery, and no ocean freight to add to their selling price.

For years Japan has produced the bulk of menthol used in the world. It is derived from the oil of Japanese peppermint, the cultivation of which has practically amounted to a government monopoly, so profitable has it been.

About six years ago, during the period of high prices following the war, American manufacturers of salves, cough drops, et cetera, who used menthol in their products, became interested in making experiments for growing the mint in this country.

Subsequently a few plants were imported, and a few years of experimentation proved that the oriental herb

flourished remarkably well here—in California at least—and the acreage was increased at a rapid rate. Two years ago the first commercial crop was produced at Porterville, California, but it amounted to only a few gallons of the crude oil. However, some important facts were proved; namely, that the Japanese peppermint plant is very hardy, will withstand heat and cold, and will thrive with much less moisture here than in its native soil in Hokkaido, a northern island of Japan, where the annual precipitation averages over 40 inches. Moreover, the individual plant has a stockier growth and heavier leaf development here, and yields a greater tonnage per acre than in Japan. As much as 100 pounds of oil per acre per season has been produced near Porterville, while in Japan 40 pounds is considered an unusual yield. The menthol content of the California-grown oil is around 70 percent, which also is in excess of the Japanese product. The Californian, therefore, has everything to his ad-

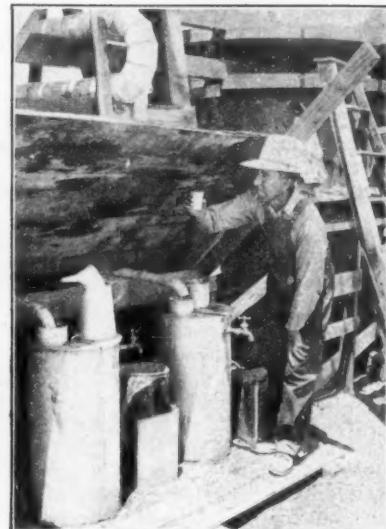
# Methods of Mint Farming

*and Used in Medicaments and Confectionery,  
Japanese Mint Farmers Than by  
Equipment and Methods*



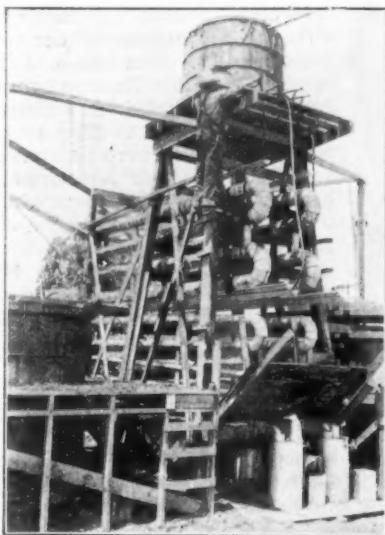
CALIFORNIA MINT

A load of American-grown mint, ready to go into the still. About 400 acres of the Japanese variety are now under cultivation in this country, Porterville being the center of the industry



TESTING DISTILLATE

The amount of oil that rises in water shows whether charge is nearing exhaustion of oil



CONDENSING COILS

Water from the tank above sprays over the cooling coils, and the oil is drawn off below



REMOVING EXHAUSTED MINT HAY

Four tubs, similar to the one shown, are installed at this still. Two tubs are steaming while the other two are having their exhausted charges removed and are being re-charged with hay

vantage in the cultivation of the plant. He does his original cultivating with a tractor, and harvests with a mower, whereas his Japanese competitor does all this laboriously by hand.

In the distillation of the mint hay, the American farmer has a modern still with a capacity of from three to ten tons of hay daily, and a production of from 50 to 150 pounds of oil daily. On the other hand the Japanese farmer produces only five to 15 pounds of oil per day, and

must work steadily for 24 hours to run through a single charge of perhaps less than half a ton of hay, for his fuel of dried bean-hulls and leaves is so light that he cannot leave his still for more than a minute or two. If the charge "goes dead," his loss is considerable.

Yet in spite of these laborious methods and the crude apparatus of the Japanese, he is able to deliver his menthol, or his oil, in New York at a price lower than is profitable for the American farmer.

# Combating the "Bends"

*Careful Regulation of Working Hours, and Better Equipment, Lessen the Danger to Workers Under Pressure*

By ALBERT A. HOPKINS

**C**OMPRESSED air is of great importance in engineering work. Subaqueous tunneling, foundations for bridges and buildings, and deep mining operations involving water could not be carried on without its aid. In the general engineering construction going on around centers like New York, a surprising number of men work under varying degrees of air pressure. The effect of compressed air upon the life, health, and efficiency of workers is therefore of necessity intensively studied by medical men.

One who has specialized in this subject is Dr. Edward Levy, physician, Transit Commission, New York, and consulting physician for the New York State Bridge and Tunnel Commission and the New Jersey Interstate Bridge and Tunnel Commission, to whom we are indebted for the following facts which are based upon his report published by the Bureau of Mines, of which he is consulting physiologist.

**I**N tunnel work, an air-compressing plant is erected near the main vertical shaft from which the tunnels are to be driven. Screened air passes from the compressor to a large receiving tank, from which, because of the great heat developed during compression, it is forced through a cooler in which water is circulated and the temperature of the air is greatly reduced. Through suitable piping down the shaft and through the tunnel bulkheads it is led into the working chambers. To ensure an uninterrupted supply, all the air lines are in duplicate.

In tunneling, a "shield" is usually used. As the shield advances, the tunnel lining is erected directly behind. This is carried on until the two shields meet, if the tunnel is driven from both shores, or until the single shield enters a shaft at the other end.

Caisson disease, compressed-air illness, or, more properly speaking, air embolism, is a condition caused by a too rapid decompression after exposure to higher pressures for a period of time. It is characterized anatomically by the presence of free nitrogen in the tissues and body fluids, and clinically, by one or a combination of the following symp-

toms: localized pain, vertigo, prostration, or symptoms referable to the central nervous system. Many theories have in the past been advanced as to the cause of compressed-air illness, but it is now universally agreed that the true cause is the presence of free nitrogen in the various parts of the body, interfering with their normal functions.

In an employment as hazardous as that of a "sand hog," attention must be paid to the class of men best fitted for it. Perhaps too much has been said in favor of thin men, young men, and athletic men generally. During the war, the Commission was forced to employ men that were very mediocre physically. Actual experience has led

individual who seeks such employment.

The out-door temperature in New York in the four years in which the work of the Public Service Commission was in progress, ranged from -13 degrees to 102 degrees, Fahrenheit, but the records indicate that temperature has little, if any, influence on increasing the number of cases of compressed-air illness. Moreover, humidity does not seem to cause any increase, although its effect is evidenced by increased fatigue. In the working chamber the temperature was always about 77 degrees, Fahrenheit, even during a hot wave which caused over 200 deaths and 2000 prostrations in the open air, as reported by the press.

The records show that the number of cases of compressed-air illness depends upon the length of time the subject has been under pressure, the height of the pressure, and the length of time taken by decompression.

**N**O case of compressed-air illness occurred until the pressure of 15 pounds was reached, although the number of decompressions by that time had reached 188,496. The number of cases that resulted from working in pressures of 15 to 22 pounds was 16, and they were all trivial, so it seems safe to subject normal, healthy men to pressures ranging up to 22 pounds for a period of eight hours.

For pressures of 22 to 30 pounds the shifts were divided into two three-hour periods, with a rest interval of three hours. There were 301 cases in 320,681 decompressions. In the next stage with pressures running from 30 to 35 pounds, the shifts being divided into two two-hour periods with a rest interval of two hours, the record shows there were 250 cases to 265,162 decompressions, the higher pressure of pounds furnishing 113 of the 250 cases. From 35 to 40 pounds the shifts were divided into one-and-one-half-hour periods with a three-hour interval for rest. There were 41 cases and 57,716 decompressions.

The hours of labor just cited do not mean the actual time spent in compressed air, but the time spent in working at the face of the shield. Where the work is far advanced, the working face may be at the middle of



ENTRANCE TO MEDICAL AIR LOCK

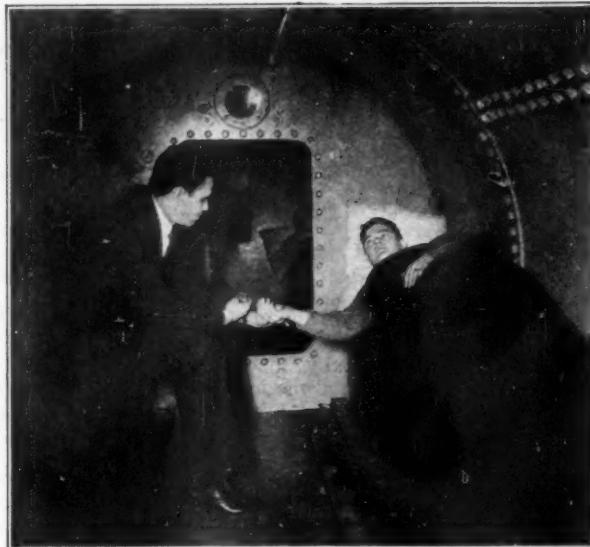
A doctor is always on hand to recompress the person injured by air pressure. The patient is entering the air lock

to the conclusion that in the selection of men the essentials are normal lungs, normal kidneys, and a good heart; in the older men the blood pressure must not be high. Tunnel workers range from 20 to nearly 60 years of age; the older men finding it necessary to give fictitious ages in order to obtain work. In reference to the employment of fleshy men, it has been found that such men are not more susceptible to compressed-air illness than is the average

the river, and much time, therefore, would be consumed in walking from the shaft. In one instance when the men were working under 48 pounds pressure, the length of time actually spent under compression was 125

until equilibrium with the normal atmosphere is established. Should the decompression be so rapid as not to permit enough time for the blood to carry the nitrogen freed from the tissues to the lungs, or should the

Levy is convinced that compressed-air illness could be limited to cases of localized pain if the hours of labor are properly adjusted and a reasonable length of time for decompression is permitted.



**DOCTOR IN MEDICAL AIR LOCK**

*The medical air lock is a boiler 18½ feet long. In serious cases the doctor enters also and controls the pressure valves from within*

minutes, although they were credited with working only two shifts of 45 minutes each, or 90 minutes total.

To determine safe working hours, comparison with previous large tunnel works of a similar nature must be made. The work on the Pennsylvania tunnel beneath the East River (1904-1909) was well conducted, excellent records were kept and the tables show that under a pressure of 40 pounds, for a period of one month, there was 1.63 percent of compressed-air illness. In the Public Service Commission tunnels in pressures above 40 pounds during the entire work the percentage of cases scarcely exceeded 0.1 percent.

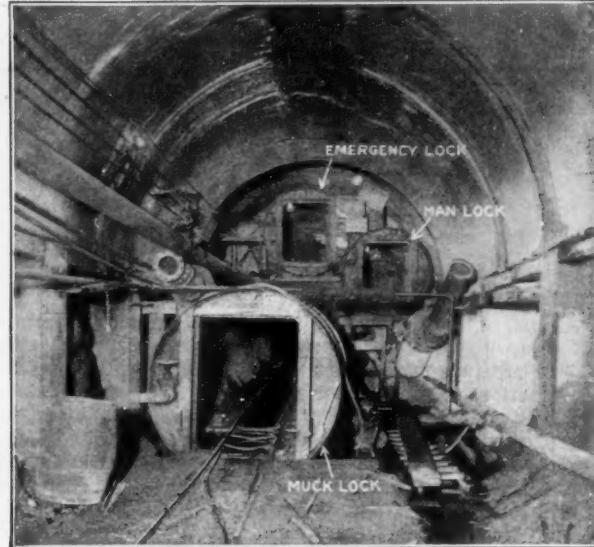
The effect of gases, including carbon dioxide, carbon monoxide, oxygen, and nitrogen forms the subject of much research which cannot be gone into here owing to the complexity of the problem. During compression, the blood while going through the lungs takes up nitrogen to its point of saturation, which increases approximately 1 percent for every additional atmosphere of pressure applied. This nitrogen-saturated blood in its circuit about the body delivers its nitrogen to the less saturated tissues and fluids and returns to the heart ready to be re-saturated and again deliver its nitrogen to the tissues.

In decompression, the action taking place is the reverse, the super-saturated tissues giving off nitrogen to the blood, which is de-saturated by going through the lungs. The blood is again saturated with nitrogen from the tissues and de-saturated in the lungs, and so on

lungs be incapable of ridding the blood of the excess nitrogen, gas bubbles of nitrogen will form in the body fluids and tissues. The formation of gas bubbles is the accepted theory of the cause of "caisson disease" or "bends."

**T**HE symptoms of compressed-air illness are: disturbances of the central nervous system which may be either motor or sensory, due to the pressure of air emboli upon the brain or spinal cord; localization of pain in the muscle fiber, tendon sheath, bone or nerve terminal, depending on where the gas emboli is present; dizziness, as the result of gas emboli in the middle ear or caused by disturbances of the central nervous system; difficult breathing or "chokes" due to bubbles of gas forced through the pulmonary arteries into the lungs; unconsciousness, or collapse, usually caused by large quantities of gas distributed generally throughout the circulation.

Cases classed as localized pain, vertigo, and "chokes," can usually be relieved by re-compression. Symptoms due to affections of the central nervous system can ordinarily be relieved by immediate re-compression, but if re-compression is postponed, destruction of the nerve elements may result and more or less permanent injury is to be expected. Unconsciousness and collapse with abdominal pain, in which a comparatively large amount of air is present in the circulation, indicate grave danger, although if treatment is prompt, recovery should follow. Dr.



**THE BEGINNING OF A TUNNEL OR SHAFT**

*The man lock is for the workmen, the muck lock is for excavated material and the emergency lock is for escape in case of accident*

The medical air lock used in connection with compressed-air work is a steel cylinder six feet in diameter and 18 feet six inches in length; one end is entirely closed and the other end has an entrance door opening inward. The cylinder is divided into two compartments of equal size by a partition with a door that opens toward the inner compartment. Both compartments contain cots on which the patients may recline. The lock has electric lights, telephone, clock, pressure gage, thermometer, electric heater, and suitable provisions made for ventilation.

The compressed-air pipes and outlet valves are so arranged that the pressure in either of the compartments can be regulated from outside the medical lock, or either compartment may be regulated from the one in which the operator happens to be. Heavy glass windows of the bull's-eye type are placed in line over both doors so that the patient, pressure gage, and thermometer can be watched from the outside. In more serious cases the doctor enters the air lock with the patient as shown in our illustration. As a drop of 20 pounds in a short period causes a rapid fall in temperature, men are provided with blankets so that they will not be chilled.

The sinister looking air lock is indeed a humanitarian device which permits men to work in compressed air with a minimum chance of injury, and the "sand hog" probably receives more careful medical attention than almost any other class of worker.



IN THE LAND OF MOAB

*Watching for the steam to come out of the wheels.  
This group of natives never saw a locomotive before*

**I**N every great museum there are gaps or bare spots which interfere with the orderly presentation of cultural objects. It is one of the functions of the director and curators to try to remedy this condition, and except in the case of paintings or other works of art, there is usually but one method to be pursued, namely, an expedition.

The Metropolitan Museum of Art possesses one of the finest and best balanced collections of armor in the world but even here and there is a bleak spot. Armor dating from the time of the Crusades is extremely rare, and there is no place so likely to offer specimens as Palestine, which was to all intents and purposes a section of Europe for a period of two centuries.

**T**HREE is so much glamour and romance about the Crusades that almost any fragment or article rises to importance. Under the Turkish regime, excavations were forbidden. In 1925, Dr. Bashford Dean, the Curator of Armor of the Metropolitan Museum,

made a preliminary survey and after consultation with the archeological authorities of Palestine, the crusading fortress of Montfort was selected as the best site for exploration. The castle was situated half way between Acre and Tyre and only about six miles from the sea. The location was so remote from any city that it had never served as a free source of building material. Although dismantled and abused, it still remained very much as the besiegers left it.

It is at this point that the writer enters the picture. To one who has made digging a pastime of a lifetime, an offer of the leadership of an expedition of this caliber was a lure which could not be resisted. If there was any resistance at all it was feeble.

Our trip to Northern Palestine for the exploration of the Crusader Castle of Montfort, briefly described in the February, 1928, issue of the SCIENTIFIC AMERICAN, was beset with no actual dangers, although we met with some difficulties, and had some experiences which may be worth the relating.



DRUMS DISLOCATED BY AN EARTHQUAKE

*Corinthian capital at Jerash, Roman city, showing drums dislocated by earthquake*

**T**HE journey up from Haifa was crowded with original experiences. Our car had hardly reached the beach before we came upon the vultures who pick up their living along the shore. A little farther along there was a touch of homeliness to the scene where at the highest ripple mark there was a continuous rosary of grape-fruit rinds, and we were reminded that there was a "Mediterranean Cruise" ship in the Bay of Acre.

We met our first caravan, a long one, on its way down from Syria. We rode over the drag ropes of a net which was being hauled in by a dozen sturdy fellows, a labor which might more profitably have been performed by a small gas engine. We saw an iron ship which had been driven high upon the beach; it was now cut in two, and was ready for launching as two separate boats.

On approaching Acre we crossed the Belus River near its mouth. We halted

# Exploring in Palestine and Transjordania

## *An American Explorer Tells of His Travels and Discoveries in the Holy Land*

By W. L. CALVER  
*Director, Montfort Expedition*

the car and photographed the spot where Pliny tells us, glass was first accidentally made by Phoenician merchants who made a fire of seaweed and noted the flux of the fine sand resulting from the alkali and heat of their peculiar fuel.

Probably no explorer ever had a more attractive site for his operations than Montfort. The castle is located on the crest of a wooded and flower-decked hill, about whose base meanders the Wady Kurn. We have done a bit of digging in our time, but we confess that we were dismayed by the extent of the ruins; they were over 300 feet long. Once fairly started, however, we realized that the proposition resolved itself into a mere question of good weather and sufficient help.

**A**LTHOUGH the medieval armor which we sought at Montfort proved to be very fragmentary, and rusted to the last degree; and while the lance and arrow points were few in number, our quest was successful to



CRUSADER'S CASTLE IN LAND OF MOAH

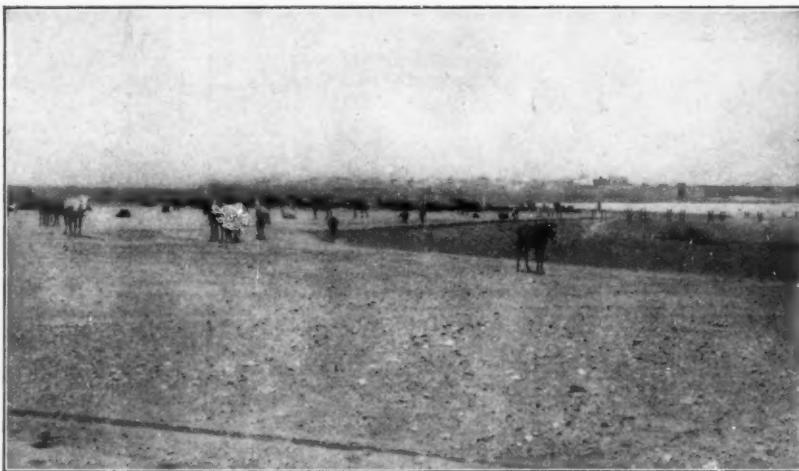
*Revetment of the Crusader's castle at Kerak, Transjordania, shows military engineering*

the extent of finding various kinds of other material which revealed the character of the castle's architecture and the daily life of its occupants.

Most conspicuous among the mementos recovered from the several chambers were the immense stone balls from the *trebuchets* of the besiegers; the identical missiles, 57 in all, which encompassed the downfall of Montfort Castle. The exploration here is more fully described in the article referred to above.

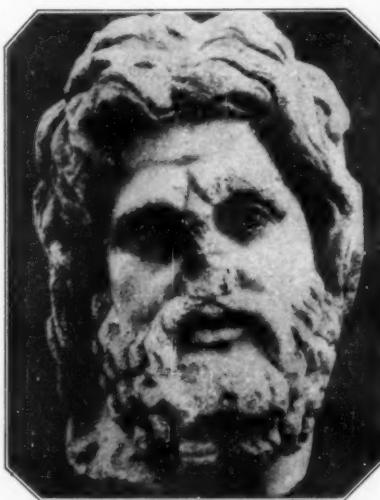
Within the old Turkish Arsenal at Acre, where our Montfort material was deposited, serving as a nucleus of a collection of antiquities to be exhibited there, are many objects which well serve to illustrate warfare as it was waged 100 years ago. In the courtyard we noticed bar-shot and fire balls, while within an alcove we saw boxes of paper cartridges for old muzzle loading muskets, and masses of gun flints of many patterns spilling out of their original cases. We were permitted to carry away a few samples of these flints which present some remarkable fine flaking, tending to prove that flint chipping, distinct from the ordinary "napping," was an art practiced by white men up to 100 years ago.

Of the one or two instances when the Orientals actually "put one over on us," we say nothing. We congratulated ourselves, however, in that we withstood the lure of a Samaritan who tempted us in the vicinity of Nabulus. When we alighted from our car to visit Jacob's Well, standing by the roadside near the gate, there was an aged Samaritan who offered for sale a tray full of beautifully iridescent little glass bottles, all whole, but set around with equally beautiful fragments of nondescript glass. One word only of his jargon we understood—"Antika;" but in sign language he led us to believe that his attractive curios were



ACRE AND THE BELUS RIVER

*Here on the Phoenician strand the first discovery of glass was made. Pliny tells us how Phoenician merchants made a fire of seaweed and noted the flux made from the sand by the alkali*



REPUTED HEAD OF CHRIST  
FROM JERASH

*Sculptured head found in the Roman city of Jerash in Transjordania. It is supposed to date from the Second Century A.D.*



AUTHOR'S CAMP AT MONTFORT

*The camp was situated below the Crusader's castle at Montfort in Palestine. All the picturesque features of the Orient are there, even to the camels. American push and efficiency was a novelty*

derived from excavations in progress on the hill nearby.

We promised ourselves that when we journeyed that way again we would buy him out. But when, at Jerusalem, we confided our intentions to some acquaintances there, they bestowed upon us looks of pity. When we asked whether there could be any doubts as to the genuineness of the Samaritan's "antiques" our friends assured us that the iridescence was the real thing all right, but the bottles were quite modern. The Samaritan had scraped the iridescent flakes from ancient glass fragments, obtained from local diggings, and had attached them, with their beauty undiminished, to the surface of his modern bottles by means of some kind of mucilage.

Our tour of Transjordania was begun on March 6th, when we went down to Jerico and passed the Jordan by the Allenby Bridge, and reached Amman near the close of the day. The modern Jerico is only about 16 miles in direct line from Jerusalem, yet one travels several miles more than that on his way down. The drop is about 3600 feet.

It is quite generally known that the Dead Sea, from which Jerico is only a few miles distant, is 1000 feet below sea level, but few are aware that Jerusalem is about 2600 feet above the sea. So great and sudden is the drop that when one goes down by car, his ears ache. At a point where our car in its course downward nearly stood on end, we asked to be assured about the brakes, and requested that the chauffeur favor the bank side of the thoroughfare rather than the extreme outer edge of the road.

We began our long trip down through the Land of Moab toward El Kerak, a populous and extremely ancient town about a dozen miles east of the Dead Sea and 3100 feet above sea level. Of



THE HEJAZ "EXPRESS"—TWICE A WEEK

*Rear end collisions are rare on this road. Nine freight cars, a passenger coach and a caboose form the equipment of the train*

the route pursued our diary says: "good road;" "poor road;" "track only;" "no track." Following the Hejaz Railway, on its way to Mecca, we arrived at lunch time at Kutrani station on the Hejaz. Two trains per week, we were told, was the schedule, and as we approached the station a train from the north pulled in. Nine small freight cars, one passenger coach and a caboose, made up the train, besides the locomotive.

THE passengers, we supposed, were all pilgrims. The train remained at the station above half an hour. Arabs, apparently of the leisure class, jibed the soldier guard, while other Arabs inspected the locomotive, speculating how the steam got into the wheels, while we sized up the two water tanks near the station which had been shelled during the war. From the engine of an Australian airplane, which had been brought down by the Turks, we pried off a brass plate which stated: "This cylinder is 1/1000 large" for a memento.

After many farewells to newly-made friends at the station, the pilgrims bundled back into the single passenger coach, the engineer rang his bell, and

the train started again for Arabia. About this time we regretted that no view of the train had been taken, but when the train had proceeded about two lengths from the station, the engineer seemed to have forgotten his



STUCK IN THE MUD

*Automobiles are in general use in Palestine and Transjordania. Here all the party are trying to extricate the author's car from a mud hole*

monkey wrench, or oil-can, or some little matter of business, so he halted the train and then backed to the station. We embraced our opportunity and snapped the engine and train head-on.

Our first contact with the ruins of the Roman outpost Jerash was when we came upon the detached triumphal arch. This well preserved and beautiful work of pink limestone is close beside the present road, yet some distance outside the line of the city wall.

THE structure consists of a central arch 21 feet wide, and there are smaller gateways at each side. The whole building has a total width of 83 feet. This florid bit of architecture has lost many of its embellishments. The calyx-shaped pedestals of acanthus leaves above the bases of the columns being now about the only carvings visible, there probably remain buried in the rubble within and about the monument, the sculptured ornamentations of the southern front of the arch.

On our arrival at the modern Circassian village of Jerash, built from the ruins of the ancient city, we became the guests of Mr. Horsfield, who for the past eight years had been engaged



FINE EXAMPLE OF EROSION

*The bridge on the way to Kerak, showing roads and how the countryside is eroded*



TRIUMPHAL ARCH AT JERASH

*This beautiful arch is built of pink limestone. The central archway is 21 feet wide. There are smaller gateways located at each side of it*



THE COLONNADE AT JERASH

*The natives have destroyed much of the colonnade by burning the drums and capitals for lime. Still the remains are quite substantial*

in clearing the Roman ruins. Mr. Horsfield rather resented being classed as an archeologist, yet as an architect he was certainly qualified for his task.

Towards the close of the day the clouds broke away and there was a beautiful rainbow in the east. Under

capitals, friezes and sundry decorations for lime, while they appropriated the dressed rectangular stones for the construction of their simple dwellings.

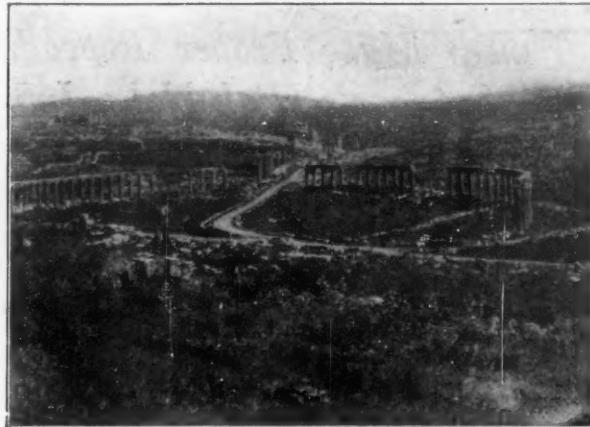
Apparently little is known of the history of Jerash. The first mention of it occurs when Josephus relates that

country men at Caesarea, at the commencement of their last war with the Romans; and it had scarcely recovered from this calamity when the Emperor Vespasian despatched Annus, his general, at the head of a squadron of horse, and a large body of infantry, to



EXPLORATION AT JERASH

*Exploration at Jerash has been carried on by Mr. Horsfield for the last eight years with notable results. A contractor's railway helps*



THE FORUM AT JERASH

*A beautiful view of this old Roman city is obtained from the hillside. City of Jerash was an important Roman outpost of the later period*

these conditions we got our first good view of the long colonade with its many standing columns. We noted the several distinct structures—the tribune, the two theaters, and the several temples, wondering meanwhile at the untarnished character of the masonry and the lack of publicity which this remarkable site had received.

WE recalled however, that in our youth we had read that there existed in Asia Minor a beautiful Roman city, almost intact; and that it was fast being obliterated by vandal natives who were burning its ornate

Alexander Jannaeus, King of the Jews, having subdued Pella, directed his march to Gerassa—as it was known to the ancients—and carried the city by assault. (Circa, 85 B.C.) Its most prosperous period was early in the Christian era. Soon after the Roman conquests in the east this region became one of their favorite colonies. Ten cities were built, or rebuilt, and the district was called "Decapolis." Of the ten cities, Gerassa was the most important.

The old guide book says: "It was among the cities which the Jews burned in revenge for the massacre of their

capture it. Annus having carried the city on the first assault, put to the sword 1000 of the youths who had not effected their escape, enslaved their families, and permitted his soldiers to plunder their property. He then set fire to their houses, and advanced to the villages around."

It appears to have been more than half a century subsequent to this period that Gerassa attained its greatest prosperity, and was adorned with those monuments which gave it a place among the proudest cities of Syria.

QUITE recently Jerash has come prominently into notice through the discovery among the ruins of its fifth century church of what is supposed to be a very early, if not the earliest, sculptured head of Christ. This head, found by Mr. Horsfield, has been a subject of some dispute. There can be little doubt however, that in its present form it represents the saviour, although there are evidences that in an original form it portrayed a pagan deity, or hero of the classic period—Greek or Roman. Yale University, co-operating with the British School of Archaeology, is about to excavate a portion of the city of Jerash. Particular attention will be paid to the early Christian church.

It has been said that little is known of the history of Jerash, yet we found in the modern Circassian village many coins of the ancient city, and in these might be found the record of this outpost, Greek in its origin, but Roman in its flourishing days, and until its downfall. Among the coins found we noted a silver drachma of dating to about 300 B.C.



TEMPLE AT JERASH

*Earthquakes have thrown down many of the columns. Where the tilting caused by the tremor is insufficient to overthrow the column, the drums have slipped as shown in a previous illustration*

# Why Is a Radio Soprano Unpopular?

*Present-day Radio Laws and Radio Equipment Make Proper Reproduction of Soprano's High Notes Impossible*

By JOHN F. RIDER  
*Associate Editor, Radio Engineering*

NOT so long ago, an elderly gentleman whose aristocratic appearance was impaired by a distinct frown, entered a radio store and addressed the clerk as follows—"You sold me a receiver sometime ago. I wish you would send some one to my home to fix my set, I hear nothing but screeching sopranos. Here is my address. Thank you."

The above is a concrete illustration of the attitude of the general radio public toward the soprano as a broadcaster. This state of affairs is indeed unfortunate, because the soprano upon the concert stage is one of the most popular, if not the most popular, of artists. But, why is the soprano disliked as a broadcast artist? We, who like the soprano upon the concert stage, do not prefer her over the radio. Our friends, who like the soprano upon the concert stage, do not prefer her over the radio. A survey among radio enthusiasts who consider radio as a medium of musical entertainment and education, shows a general dislike for the radio soprano. As much as we would like to state that she is a de-

lightful radio artist, we cannot in justice to other radio performers speak in the affirmative.

The art of radio reception, marvelously developed as it has been during



BEAUTY AND THE "MIKE"

*The lot of the radio soprano is a hard one. Radio instruments seem to conspire to prevent the successful broadcasting of her voice*

## A Question Answered

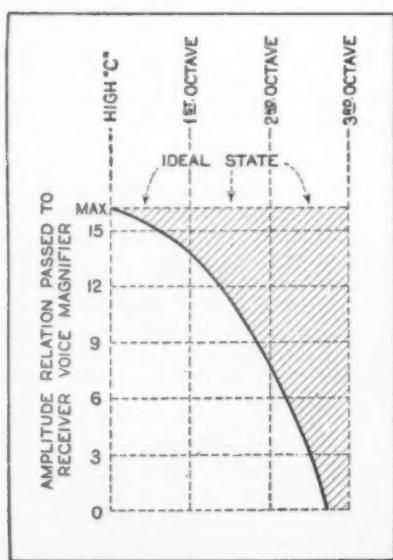
ON the concert stage, you enjoy greatly listening to your favorite soprano. One evening you see in the radio program published in your local paper that she is to broadcast. With anticipation you tune in carefully and settle back to revel in the sweet beauty of her voice. The announcer . . . the opening chords . . . the soprano herself . . . and a rude awakening. Soul inspiring on the stage . . . a veritable "flop" on the radio is the sad lot of the soprano. Why? The question is answered in these columns by one who has made a careful study of the whys and wherefores of radio instruments, and answered in a way that gives all of the reasons.

*The Editor.*

fortunate for the artist because it means the preservation of her reputation, which justly belongs to her.

The reasons why radio is not yet ready for the soprano are numerous. In the first place, the speech characteristics of woman in general, with respect to aural comprehension, are inferior to those of man. Dr. J. C. Steinberg of the Bell Laboratories, states in *The Bell Laboratories Record* that women are found to talk less distinctly than men. Secondly, the speech characteristics of woman, when changed to electrical impulses, do not blend with the electrical characteristics of our present day radio equipment. Thirdly, the demand of the radio public for radio equipment to meet their aural fancy has led to design of equipment that impairs the reproduction of a soprano's voice. Therefore, we see that the reasons for the enigma are both physical and electrical.

the past eight years, is not yet ready for the soprano as a broadcasting artist. It is unfortunate, but true. Innumerable music enthusiasts who have never had the occasion to listen to a popular artist upon the concert stage but who have heard of her reputation and anticipated a delightful rendition of their favorite song, have been sadly disillusioned when she was heard via the air. This statement is made in direct contradiction of the wide acclaim supposedly accorded to some of our famous sopranos upon their radio performance. The heralding of the appearance of a famous soprano at a well known broadcasting station, immediately creates a favorably biased opinion. The reputation naturally precedes the performance. If the performance is unsatisfactory, as it invariably is to those well versed in musical lore, some excuse is hurriedly found. Seeking an excuse to justify the received performance is in order, so as to reconcile one with the disappointment. That this is done is indeed



**IN STATION SELECTOR**  
Tuner reduces intensities of higher octaves.  
Curve may be straightened in the future

IT may sound strange to hear that man is more readily understood than woman, and that for radio transmission a man's voice is better than a woman's. Nature has so endowed women that they can more easily pronounce such words as "thin" and "fat," such sounds as "th" and "f," but these sounds are most difficult to hear. Dr. K. S. Johnson of the Bell Telephone Laboratories says in his book on telephone transmission circuits, "'th,' 'f' and 'v' are difficult to hear, regardless of the intensity, and account for over 50 percent of all the errors occurring in commercial telephone systems . . ." Our radio equipment is very similar to that used in telephone practice and effects found in telephone practice hold true in radio.

For a basis for determining why the soprano is not a satisfactory broad-

casting artist, we must delve somewhat into the physical and the electrical. Speech sounds in general are not simply tones but, on the contrary, are quite complex. Analysis of a tone, complex in nature, shows that what we hear consists of a number of individual tones of varying intensity. That is to say, a complex tone or sound consists of a fundamental tone and a number of harmonics and overtones. In contradistinction to musical instruments such as the pipe organ and the tuning fork—which instruments produce pure tones consisting of just one value of vibrations per second, or frequency—human speech sounds are quite complex and consist of a number of values of vibration per second, or frequencies.

In other words, a certain speech sound may have a fundamental of 300 vibrations per second and a number of harmonics of say 600, 900, and 1500 vibrations, or cycles, per second. The timber of a sound or its complete tone is governed by the relative amplitudes of the fundamental and its associated harmonics. Decrease or increase the relation of the fundamental and harmonic amplitudes or intensities, and the timber of the audible sound has been changed. Herein lies the basis for the recognition of the various musical instruments or the recognition of a human voice. The preponderance, the absence, the variation in amplitude or intensity, and the number of harmonics present, provide the distinguishing characteristics between musical instruments and the speech of humans.

UPON analysis of the voice range of a soprano, it is found to extend from the "B" just below middle "C" on the piano to the "F" above the second "C" octave above middle "C" on the piano. Interpreted in the number of vibrations per second, the range extends from approximately 240 to 1365. This is the range of fundamental notes within the range of a soprano's voice. Singing a note within this range does not mean that only that note is present, as we hear it. The sound emitted by the singer contains the fundamental and a number of its associated harmonics.

Analysis has shown that the closer the fundamental to the high limits of her voice range, the fewer the harmonics and, conversely, the lower the fundamental within her voice range, the greater the number of harmonics. At all times, however, we must contend with a fundamental and a number of harmonics. The musical value of any tone or note is due to the presence of the harmonics. Remove all the harmonics and the tone has been changed to a sound devoid of all mellowness or sweetness or richness. If the original note is high, such as high "C" sung by a soprano, and all the harmonics are removed or attenuated or

diminished, the final sound will be a shrill shriek or whine, entirely unmusical. In fact it is not essential that all the harmonics be removed or diminished. Accentuation or attenuation of some of the harmonics will produce disagreeable effects.

THE loss of overtones and harmonics, and the accentuation of some of the harmonics are the reasons for the defeat of the soprano as a radio broadcast artist. Present day radio instruments are not equipped to transmit and respond faithfully to the overtones and high harmonics of a soprano's voice.

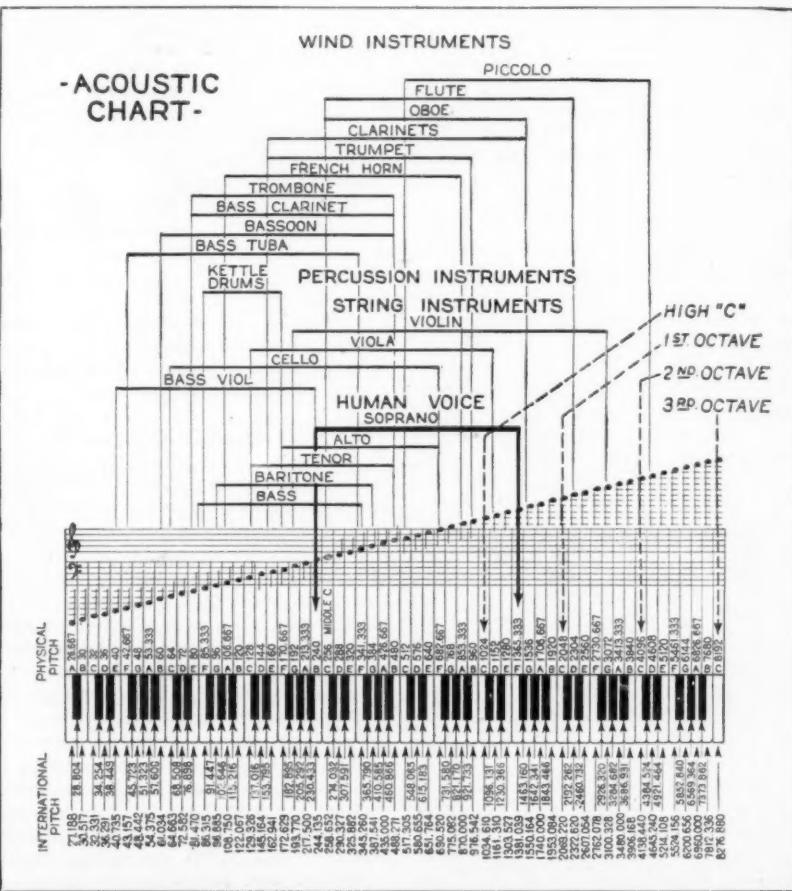
A simple example of this phenomenon in everyday radio reception, is a duet between a tenor and a soprano, or a baritone and a soprano. In both instances, the soprano's voice is lost; the male voice predominates.

A soprano appearing upon the concert stage sings to a listening audience. Her voice is carried through a medium, the air, which does not attenuate or accentuate the frequencies produced by her vocal cords. Distance will diminish intensity but will not vary the amplitude relation between the fundamental and the harmonic fre-

quencies produced by her vocal chords. The ear of the audience to whom is conveyed directly through the air the relative amplitudes of fundamental and harmonic vibrations, without attenuation or accentuation, hears the sweetness and richness of the soprano's voice. With the air as the only transmitting medium, without accentuation or attenuation of harmonics, and with the wide response range of the human ear, the listener hears a delightful performance. The same singer, performing over the radio, sounds disagreeable.

THE human ear is both a sensitive and an insensitive organ. It is sensitive in varying degree to pitch, being uniformly sensitive to the normal fundamental ranges of the soprano's voice. On the other hand, the human ear is a poor judge of intensity. With respect to pitch variations, however, we find a variation of approximately .3 percent as being perceptible over a soprano's voice range.

We have said that a pure tone is not musical, that the sweetness of a tone is found in the combination between the harmonics and the fundamental. Now let us suppose that a soprano sings high "C." This note is of approxi-

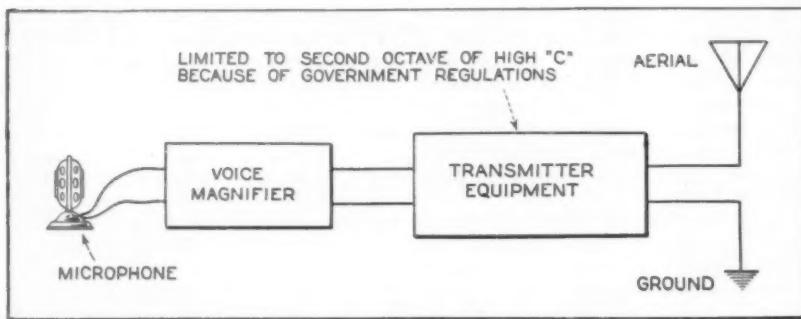


ACOUSTIC CHART OF THE PIANO SCALE

This chart serves to show the sound ranges of various musical instruments, and of the human voice. Here the third octave of high "C" has been added to the regular piano scale at the right

mately 1024 vibrations per second, otherwise quoted as having a frequency of 1024 cycles per second. The overtones and harmonics of this note, which give it its timber, would contain frequencies which would be the second, third, fourth and even higher multiples

she does on the stage of a concert hall. The loss of overtones or variations in amplitude of the fundamental and harmonic vibrations is not limited solely to the single note we quoted but is applicable to all others. Not that they are always lost but rather that



SIMPLIFIED SKETCH OF RADIO TRANSMITTER

*The microphone converts sound waves into electrical vibrations, which are passed to the voice magnifier or amplifier. Here the fundamental and harmonic amplitudes often are changed*

of 1024 vibrations. For purposes of illustration, let us assume the presence of only two octaves as harmonics. The energy distribution on the fundamental and the harmonic vibrations has no fixed law, varying with the sound produced, the characteristics of the instruments, and the person producing the sound. In some instances, the fundamental vibration has more energy than the harmonics. In other cases, one of the harmonics may have more energy than the fundamental. This should be remembered for future reference.

REFERRING again to the high "C" mentioned in the preceding paragraph, the first octave above high "C" would have a frequency of 2048 cycles or vibrations per second; the second octave would have a frequency of 4096 cycles or vibrations per second. The selection of high "C" as an illustration, is based upon a phenomenon most frequently observed. The soprano when singing in a broadcasting station sounds most disagreeable when she attempts to reach the high notes. Mind you, we say that she *sounds* disagreeable. If listened to personally in a concert hall, she would doubtless be a delight to the ear. Over the radio however, she is poor. The reason for her failure over the air is found in the loss (total) of the above harmonics in the illustration cited or in the accentuation or attenuation of either one of the two harmonics. The final result is a change in the relative amplitudes or intensities of the fundamental and harmonic frequencies. The loss of the above two harmonics when she sings high "C" would result in the loud speaker reproduction of a shrill unmusical shriek. Whenever harmonic intensities are faithfully retained, the soprano sounds as well over the air as

their loss creates the same effect. Faithful reproduction is obtained only when the fundamental and harmonic vibrations and their respective intensities are faithfully retained.

If readers will attempt to recall, a radio soprano is not disagreeable to listen to when she is singing notes within the lower half of her voice range. The reason for this is two-fold. First, her voice on these frequencies is richer in harmonics. Secondly, a greater percentage of these harmonics are reproduced with the average radio set, because their frequencies are lower. The greater richness of harmonics compensates somewhat for the partial loss of the high overtones, and even if the voice, as reproduced, does not contain all of the very high overtones and harmonics, the low overtones and harmonics which are present are sufficient to give to the reproduced tone the required sweetness and lucidity.

UNFORTUNATELY, however, the beauty of a soprano's voice is found in her ability to sing high notes. Her high notes are of high fundamental and high overtones and harmonics. Present radio equipment is not capable of faithfully retaining these high overtones and harmonics. Consequently a radio soprano's voice, when she sings high notes, will remain disagreeable until the proper changes can be made without destroying the quality of reproduction for other frequencies.

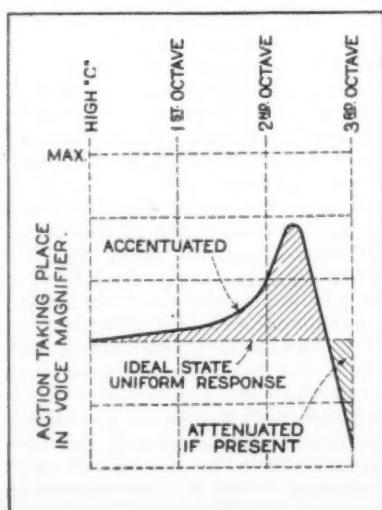
Now that we know why a soprano sounds disagreeable, let us see where the loss of overtones and harmonics occurs. An analysis of transmission systems brings to light two significant facts. First, that powerful, well-equipped and scientifically designed broadcasting stations are capable of satisfactorily transmitting a soprano's voice, that is, to such an extent as to

permit very satisfactory reproduction if receiving sets were so designed.

It may sound strange, however, to hear that the government limitations imposed upon broadcasting stations has an effect upon the satisfactory reception of a soprano's voice. In preceding paragraphs, we considered only two octaves when high "C" is sung. A third octave would be equal to a harmonic frequency of 8192 cycles or vibrations per second. The transmission of this frequency is prohibited by the government, since only 5000 cycle sidebands are permitted. An extension of the permissible transmitted sideband to 10,000 cycles would aid materially. At the present time, the broadcasting station would involuntarily be obliged to cut off all frequencies above 5000 cycles in the sidebands.

HENCE a change in the timber of the voice is effected at the broadcasting station. The loss of this third octave may not introduce an appreciable change, but that, in addition to what takes place in the receiver, results in the disagreeable and disparaging statements made about our radio sopranos.

The second phase to consider is the other category of broadcasting stations which do not faithfully transmit a soprano's voice. The difference between the two classes of broadcasting stations is found in the equipment which intensifies the sound waves after they have been picked up by the microphone and converted into electrical impulses. A certain amount of intensity magnification is necessary before the sound wave, now converted into an electrical wave, is propagated from the transmitting station radiating system. During the passage of these electrical impulses through the amplifying or



THE AMPLIFIER'S PART

*The amplifier or magnifier in the receiver often attenuates or accentuates as shown*

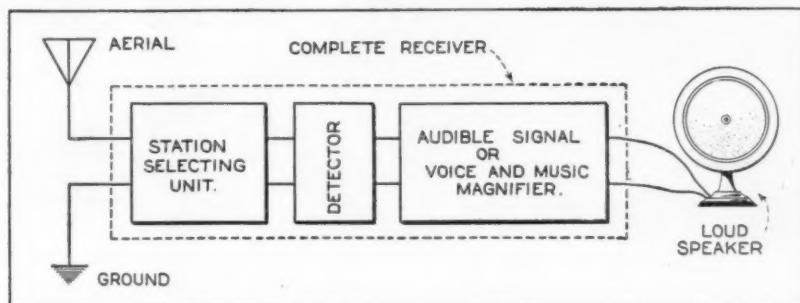
magnifying equipment possessed by the poor and mediocre stations, the relative intensity amplitudes of the fundamental and harmonic vibrations are either attenuated or accentuated with the final result that the electrical impulses transmitted to the receiving set are no longer faithful conversions of the original sound wave emitted by the singer and picked up by the microphone. Were it possible to listen to the signals transmitted from such stations, without recourse to a receiver, we would immediately note the poor response.

**T**HE transmitting station is not the only contributor. Let us turn to the receiver. Here we must again convert the electrical impulses to sound waves. The actual process is somewhat complicated, but a description of it is not necessary for comprehension of the points at which a soprano's voice is distorted. The first source of trouble is that portion of the receiver which provides for the satisfactory selection of the station to which one desires to listen. The parts of the receiver, or the complete system of the receiver which gives it this property of station selection, produce an effect equivalent to the limitations of the aural tones which can be passed through the receiver and reproduced by the loudspeaker. This is called sideband suppression. Not that this portion of the receiver curtails the tones which the speaker will reproduce, but rather it limits the overtones and harmonics and the intensity of the overtones and harmonics which can be passed on to the other parts of the receiver and finally through the speaker.

The next factor in the receiver is the system that magnifies the aural tones which have been passed into it from the preceding system. This is the audio

amplifier. Here we find that the design of the units comprising this system is the governing factor controlling the attenuation or accentuation of overtone and harmonic vibrations passed through the amplifier. Here we find the system which, if incorrectly de-

signed, would alter the relative intensities of the fundamentals and harmonics of a soprano's voice. The speaker is the greatest contributory factor to poor reproduction of the soprano's voice. Assuming perfect transmission and perfect receiving equipment, exclusive of the speaker,



SIMPLIFIED SKETCH OF RADIO RECEIVER

*In the station selector or tuner, relative amplitudes of fundamentals and harmonics often are changed. In the amplifier they are attenuated or accentuated and, in the loudspeaker, high overtones and harmonics are not reproduced. Result—poor reproduction of the soprano's voice*

signed, would alter the relative intensities of the fundamentals and harmonics of a soprano's voice. Here we find the system which, by not properly passing or amplifying the two overtones of the illustration cited above, would greatly contribute to disagreeable reproduction.

**P**oor reproduction of a soprano's voice in general is greatly attributable to the operating qualities of the audio magnifying or amplifying system. Here we find that some of the units have the property of accentuating some of the vibrations which constitute the harmonics and overtones of a soprano's voice when she sings a high note. In other words, the second octave of the illustration cited might be magnified to an extent 100 percent or 150 percent greater than that existing in the original sound wave as produced by the singer. Some audio amplifying systems possess the quality of attenuating or diminishing rather than accentuating or increasing the proportion between the relative amplitudes of the fundamental and harmonic vibrations. The result is the same, namely, distortion of the singer's voice.

In all justice to the designers of radio equipment, we must qualify the preceding discussion of audio amplifiers. Many manufacturers of equipment suitable for use in audio amplifying systems have designed instruments which do not accentuate or attenuate frequencies passed through them and would not effect the soprano's voice in the manner we have discussed. The majority of receivers, however, do not employ such perfect equipment.

From the amplifier, we proceed to the speaker. Here we find the greatest deficiency of all because the majority of speakers respond very

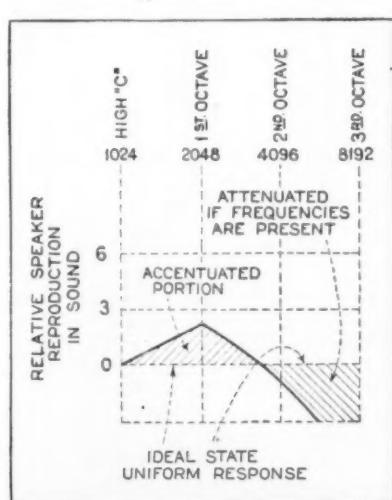
poorly to the harmonics and overtones of high notes sung by sopranos. The speaker is the greatest contributory factor to poor reproduction of the soprano's voice. Assuming perfect transmission and perfect receiving equipment, exclusive of the speaker,

the latter in itself would be sufficient to cause disagreeable reproduction by lack of response to the high vibrations found in the overtones and harmonics of high notes sung by sopranos.

The greatest source of trouble in what we can classify as a good receiver installation is the loudspeaker, because it lacks response on the higher audio register and because its response is far from uniform over the audio frequency band, particularly on the vibrations represented by the overtones and harmonics of a soprano's voice and by the keys on the higher portion of the treble scale of the piano.

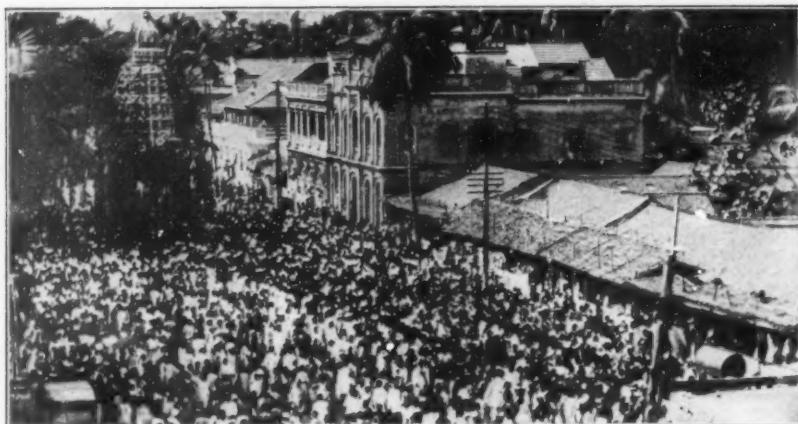
**T**HE last but by far not the least important contributory cause for poor reproduction of soprano voices, is the general public demand for exceptional reproduction of the vibrations representing the bass portion of the piano scale and the tones produced by such instruments as the bass viol, bass tuba, bassoon, kettle drum, cello, and trombone, and human voices such as the bass, baritone, tenor, and contralto. The presence of the vibrations produced by these instruments and faithful retention of amplitudes, give the richness and depth to musical reproduction and aid in the production of sounds which sound mellow to the human ear.

Unfortunately, the attainment of reproduction of the tones produced by these instruments and by these singers has thus far been carried out at a sacrifice of the higher notes and tones. Receivers have been designed for special cases and the same is true of loudspeakers when operated with certain receivers, with which excellent reproduction of the soprano's voice is possible, but on the whole, faithful reproduction of a soprano is still impossible with the average receiving set.



WHAT THE SPEAKER DOES

Chart showing how the loudspeaker changes the relative amplitudes of fundamental and harmonics by not reproducing uniformly



Hordes of Humans in Over-Crowded Parts of India

*A religious gathering preceding an uprising. As the famine or starvation line is approached such troubles tend strongly to become manifest. The immediate cause is not always the basic cause*

## The Menace of Increasing Population

*The World Is Filling Up At a Wholly Unprecedented Rate, and An Avalanche of Trouble Threatens It. What Is the Remedy?*

By SIR GEORGE H. KNIBBS

*Fellow of the Royal Anthropological Society; Formerly Statistician to the Commonwealth of Australia; President, Australasian Association for the Advancement of Science, and President, Royal Society of New South Wales*

WHENEVER Nature is lavish with food supplies for her creatures, their reproductive powers cause them to attain to numbers which later occasion trouble. As soon as she becomes less lavish, many of them must perish.

In pastoral lands sheep and cattle in good seasons multiply rapidly; in times of drought they die in great numbers, and suffer greatly. Nature has no regulative arrangements for insuring that food supplies shall be adequate to meet the requirements of natural increase. Thus, in countries where human fecundity is practically unrestricted, as in Russia, China, and India, populations oscillate: in good seasons they increase; in bad times, enormous numbers perish miserably.

Civilization attempts to minimize the suffering and to avoid the needless inroad of death. Man in general, however, little realizes the true significance of his own rates of increase, or recognizes that they may point to ghastly suffering. We may well ask, therefore, at what rates has he been able to increase, and what do such rates imply?

In the United States from 1790 to

1860 the population aggregate increased at a sensibly uniform rate of about 3 percent per annum; since then, however, it has fallen off considerably. From 1921 to 1925 the people of Australia annually increased about 2.09 percent. From 1881 to 1910 some 19 countries (which have accurate statistics) increased yearly about 1.08 percent; and between 1845 and 1914 the world increase was over 0.7 percent per annum. What do such rates mean for human food supplies and for human conditions generally? That is our problem.

POPULAR imagination does not grasp the significance of rates. History goes back perhaps 10,000 years. In that time, a single pair increasing annually at the rate of one per thousand, would become only 43,833 persons; and it would take no less than 20,708 years to attain to 1,950,000,000, about the present population of the globe. To suppose the impossible, if an annual increase of one per hundred could continue for 10,000 years, the total reached would be represented by the figures 32,716,573 with 36 ciphers

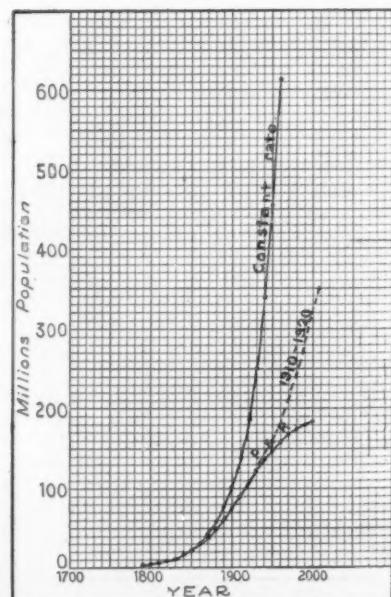
following. Some faint conception of the importance of this colossal number can be had if we remember that, were the average weight of a human being only 100 pounds, no less than 248,293,000 million million earths would be necessary to provide material for their bodies!

These illustrations enable us to see at a glance that such rates of increase as have been recently experienced by the human race, can have continued but for a short time; or else the earth must have witnessed appalling catastrophes for man from time to time.

And moreover we cannot fail to see that the existing rates are ominous for our future. Naturally, we ask, "Why is man now increasing so rapidly?" Self-evidently, a new factor has appeared. This factor is his recently acquired systematized knowledge of Nature and the development of his powers of invention.

THESE have given him a better insight into the resources of his environment and greater skill in exploiting it. He can place natural products where they can be of most service and can make them more abundant.

Man's most recondite conceptions in the realms of mathematics, physics and chemistry, have proved to be of incalculable value. He has become the creator of a new order of things. His psychological and sociological studies are making the adjustment of his various relations more easy. He has a better insight into the economic conditions of life generally, and he has gone far to correlate the various realms of his knowledge. All this has opened up new possibilities for human increase, and man has multiplied ac-



OUR FUTURE GROWTH  
*The sigmoid curve of Pearl and Reed (P. and R.) is the expectation of our growth*

cordingly, and "replenished the earth."

Nevertheless, this advance cannot go on, as we have already seen, without limit. The earth can carry greater numbers than in the past, because of man's progress in science and invention. But it has sharply defined limits. Various forms of life have appeared and already have passed away. Why? Answers have been attempted and from them we can see that Nature is not without conflicts of interest in respect to her creatures.

THE earth's surface is only about 197.05 million square miles. Neglecting its polar areas, its land-surface is about 52.5 million square miles. Agricultural data exist for about 46 percent of this, the corresponding population being about 41 percent of the world's total. Parcelling out the whole area on the assumption that it is similar to the available data, would give, in millions of square miles, the results shown in Table I.

Arable lands are thus only about one tenth of the whole land-surface of the world. One sees at once that the available area for the effective use of human beings is, after all, very limited. In different countries the percentages of area available for cereals and food crops range between 0.1 for Tunis and

TABLE I  
Division of World's Land Area  
(in Millions of Square Miles)

Total	52.5
Unspecified	22.5
Non-productive	13.6
Productive	16.4
Pastures	2.8
Shrubs	0.2
Forests	7.3
Marsh	1.0
Arable	5.1
Grasses	0.79
Foods	0.39
Industrial	0.37
Seeds	0.02
Cereals	3.53

plies. A mere inspection of areas would be very misleading. The fact is that a very large portion of the earth's surface is not fitted for human occupation, nor is it usable for the growth of man's food supplies, either animal or vegetable.

In this connection it is worth noting that the total of the number of horses, cattle, sheep, goats, pigs, asses, buffaloes, camels, caribou, deer, elks, elephants, llamas, reindeer, are sensibly the same as the number of human beings. And further, that from the point of view of human food supply, they cannot be dispensed with; and, although we may make a much larger use of sea mammals, fish, and sea products generally, both for food and for general purposes, the possibilities of human increase are not substantially altered thereby.

Life in the sea world is already balanced by factors operating in that domain. Man is a land animal, and the 52.5 million square miles is his domain, only part of it being really serviceable. Later we shall again refer to the light this throws on the limit of the world's population.

RETURNING to the question of rate of increase, that which characterized the population of the United States affords one of the best possible examples of its intrinsic nature. From 1790 to 1860 its average value was 3.01577 percent per annum, from which it never deviated except slightly. The comparison of the actual numbers with those which represent a constant rate is presented in Table II.

This rate then decreased, and the extraordinary significance of that decrease is indicated by a comparison again between the actual figures and those which would have been reached had the constant rate continued. The differences, shown in Table II, are very striking.

These differences are due in part to social changes, and in part to unavoidable difficulties in exploiting one's physical environment. It is worthy of note that the constant rate of the table

would have given by the year 2000 a greater population for the United States alone than the whole world at present contains!

To continue the comparison further, we give in Table III not only the numbers but also the corresponding densities in persons per square mile, taking the area of the United States as 3,026,789 square miles. We see that were it possible for the rate from 1790 to 1860 to continue to the year 2000, the United States would be peopled nearly as densely as England and Wales are today, the density there being 670 per square mile. Professor Raymond Pearl and Dr. L. J. Reed, on certain assumptions, estimate that the United States cannot carry more than 65.176 per square mile, a density which it would have already by far exceeded.

By changes in the standard of living, however, by improvements in the food supply, and by better economics generally, the density of 65 per square mile can greatly be exceeded, but the figures for year 2000 and later are, of course, hopelessly impossible.

WE pass on now to consider the existing position for the whole world. It has already been noted that from 1881 to 1910, 19 countries increased at the rate of 1.08 percent. From 1906 to 1911, 26 countries increased at the rate of 1.16 percent. Obviously we may take an annual increase from 100 to 101 as an appropriate basic assumption for a study of the world's increase in the immediate future. We have already seen that it cannot last for many centuries. Starting with say 1950 millions in year 1928 we get the results shown in Table IV.

Thus we see that by the year 2100 the world's population would be more than five and a half times what it is now, if the rate of 1 percent increase annually could be maintained.

It may bring the matter into more direct touch with one's imagination, if we turn back to the rate of growth of the United States population from 1910 to 1920, *viz.* 1.402 percent per annum, or 14.938 percent per decennium. In the middle column of Table V the figures in millions for this rate of progression are given; in the right hand

TABLE II  
Comparison of U. S. Population  
Increase in Millions With  
the Constant Rate

Year	Actual Number	Rate Constant
1790	3.929	3.929
1800	5.31	5.29
1810	7.24	7.12
1820	9.64	9.58
1830	12.87	12.89
1840	17.07	17.36
1850	23.19	23.36
1860	31.443	31.443
1870	38.56	42.32
1880	50.16	56.93
1890	62.95	76.67
1900	76.00	103.20
1910	91.97	138.90
1920	105.71	186.95
2000	?	2013.76

43.1 for Czecho-Slovakia; and for the whole world may perhaps be taken as under 8 percent. The productivity of the various areas differs as much as seven times. Thus Russia in Asia produces 7.0 bushels of wheat per acre; Tunis 7.1; while Denmark produces 51.0; and the Netherlands 49.2. The world average is probably slightly over 14 bushels of wheat per acre, *viz.* the rate of yield of Spain, Jugo-Slavia, Australia, and Canada, (1921). The United States yield is slightly lower.

Facts such as these remind us that something more than a mere survey of areas is necessary to ascertain the possibilities of the world's food sup-

TABLE III  
Persons per Square Mile Forecast  
for United States at Present  
Rate of Increase

Year	Constant Rate	Density
1920	187	62
1950	456	151
2000	2014	665
2050	8896	2939
2100	39296	12983
2150	173591	57531
2200	766830	253348

TABLE IV

Future Population of World  
1 percent increase per year

1928.....	1950 millions
1930.....	1989 millions
1940.....	2197 millions
1950.....	2427 millions
1960.....	2681 millions
1970.....	2962 millions
1980.....	3271 millions
1990.....	3614 millions
2000.....	3992 millions
2050.....	6565 millions
2100.....	10797 millions

column the figures are as given by the theory of Professor Pearl and Dr. Reed.

These final figures are based on the view that 197,274,000 is the greatest population the United States can ever carry, and that the rate of increase is always proportional to the deficit from this, divided by this number. Such a result, however, indicates that the United States can never on the average be populated to one tenth of the density actually now existing in England and Wales and in Belgium, where the densities are respectively 670 and 665 per square mile, while the limit for the United States would be only 65.18.

EVEN if the constant annual rate of 1.402 percent could be maintained, the density for the year 2000 would be only 106.38 per square mile. The dotted line on Figure 1 illustrates the numbers which would be reached if the rate from 1910 to 1920 were to continue.

A survey of the rates of growth in various countries, taking also into account their natural possibilities, shows that some can greatly increase their populations as soon as the necessary conditions are realized. This fact suggests that excessive densities of population might well be relieved by appropriate migrations. The actual population-carrying power of different regions, however, differs enormously, and although it is not revealed directly by existing population densities, it is to some extent indicated thereby, especially if we take large areas into account. Refer to Table VI.

The geographical irregularity of these densities is worthy of notice, as is also the character of the civilization prevailing, and of the forms of government of the various countries. Density of population is dependent, not merely upon the natural wealth of the territory inhabited, but also upon the intelligence and technical knowledge of the inhabitants, their character and thrift, their standard of living, their social economics, their relations with other peoples, their political outlook and aspiration; in short, upon their character and culture.

Recent accessions of scientific knowledge, and better grasp of the possi-

bilities of its applications to man's needs, as well as skill in invention, have expressed themselves in an increase of his food supply, and have thus brought about corresponding increases in the numbers occupying particular territories.

Countries like Germany and Japan, however, are not living solely upon their own food productions; they must force exchange the products of their secondary industries in order to make good the shortage in their own production of food-stuffs. When this is taken into account, the question of the futures of territorial densities of population becomes more complex.

The fact that nations are not living in assured peace and that they are variously circumstanced in regard to the

TABLE V  
Future Population of the United States. Comparison of Constant Rate with Theory of Prof. Pearl and Dr. Reed, in Millions

Year	Increase Constant	Pearl-Reed Theory
1930	121.5	122.4
1940	139.7	136.3
1950	160.5	148.7
1960	184.5	159.2
1970	212.1	167.9
1980	243.7	174.9
1990	280.1	180.4
2000	322.0	184.7

production of the necessities of life, has to some extent forced upon them the insuring of that measure of trade and commerce without which they cannot maintain their peoples in good condition. Professor E. M. East in "Mankind at the Crossroads" has dealt with this aspect of the question sufficiently to show that with increases of population we are moving toward more and more critical situations. Studies, like those of Mr. O. E. Baker of the Agricultural Economics section of the United States Department of Agriculture, afford also an indication that for the United States, for example, the outlook is disquieting for the future, if it be hoped to maintain the present standards of living.

WE have already seen that to keep up the rate of population increase reached between 1910 and 1920, we should have to make the increase of food-stuffs in 1980, say, double what they would be in 1930 (see Table IV). Or, what amounts to the same thing, population and its requirements would double every 49.786 years. In, say, about 250 years, the 105,711 millions of the United States in 1920 would reach no less than 3383 millions. It is these considerations that have compelled the recognition of the fact that increases of populations increase the

difficulties of growing at the same rate.

"Can migrations greatly diminish difficulties arising from the over-rapid growth of populations?" is a question now presenting itself to the world-mind. Obviously, were there no intrinsic difficulties, they could temporarily alleviate the situation.

But there are difficulties. Differences of color and physique, of standards of living, of political and social outlook, of prevailing hygiene, of language, and of average wealth, all hinder migration.

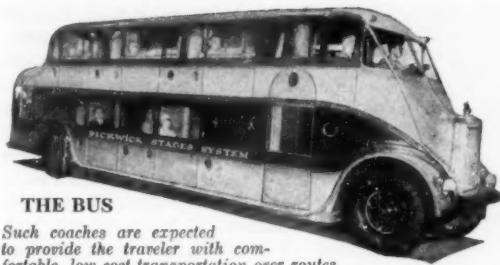
MANKIND is very far from a homogeneity for the purposes of intermixture. Moreover, successful migration often demands that migrants shall be specially endowed as regards intelligence, courage, and pertinacity. Not infrequently they must have a modicum of capital to succeed. The occupants of a territory are not prepared to welcome the derelicts of other countries. Often other countries will not lose willingly their better and thriftier citizens who wish also to carry away some of the countries' wealth.

Another factor of importance is that the power to absorb migrants is very varied. Enormous areas in South America, in Africa, in Russia, in Asia, and in Australia could be peopled, were the conditions for absorption really suitable. But they are not so at present, and the absorbing countries would be involved in considerable outlay in taking in immigrants. One need only

(Please turn to page 377)

TABLE VI  
Population Density of Entire World

Division or Country	Persons per Square Mile
<b>Continents</b>	
Europe.....	127.6
Asia.....	65.2
Africa.....	10.6
North and Central America.....	17.5
South America.....	9.5
Australasia and Oceania.....	2.7
<b>Countries of over 100,000,000</b>	
British India.....	226
China.....	109
Russia.....	75
United States.....	39
<b>Countries of over 50,000,000</b>	
Germany.....	347
Japan.....	320
Feud. Ind. States, Asia.....	101
Neth. E. Indies.....	89
<b>Countries of over 10,000,000</b>	
England and Wales.....	670
Italy.....	339
Czecho-Slovakia.....	265
Poland.....	195
France.....	192
Rumania.....	142
Jugo-Slavia.....	125
Philippines.....	99
Nigeria.....	59
Egypt.....	37
Abyssinia.....	29
Turkey.....	25
Persia.....	19
Mexico.....	19
Brazil.....	9.3

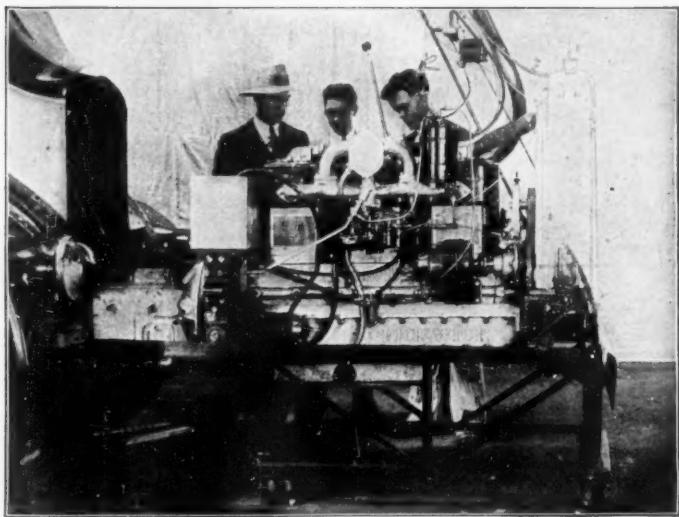
**THE BUS**

Such coaches are expected to provide the traveler with comfortable, low cost transportation over routes and through districts hitherto unprovided with such service. This coach carries 26 passengers and their luggage.

**A** 13-COMPARTMENT automobile bus, a veritable motor-Pullman having a sleeper capacity of 26 persons on two decks, has just been built by a large stage company of Los Angeles. The company will use it on the San Diego-San Francisco route. Additional similar buses will eventually extend this service to Vancouver, Canada, and across the country to east-coast cities.

The body of this bus, the unique design of which may be seen from the illustrations, is made of duralumin so that the total weight is only 14,000 pounds. It is 34 feet six inches long, eight feet wide, 10 feet three inches high, and cost nearly 30,000 dollars. Every compartment

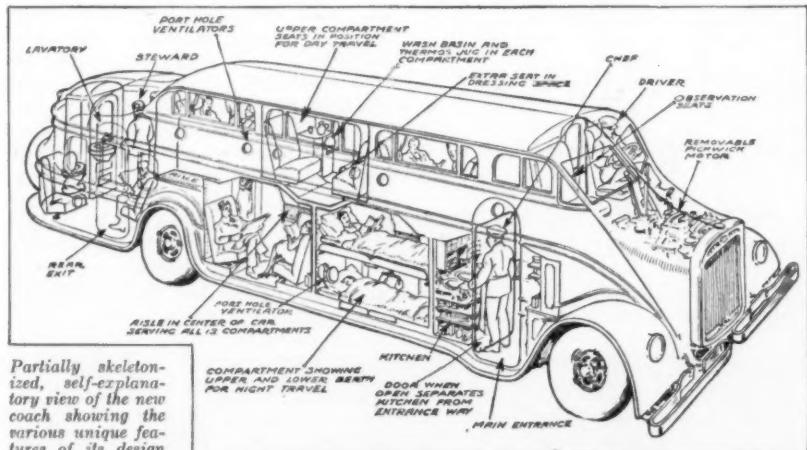
# Motor Sleeping Coach



P and A

**THE REMOVABLE MOTOR UNIT**

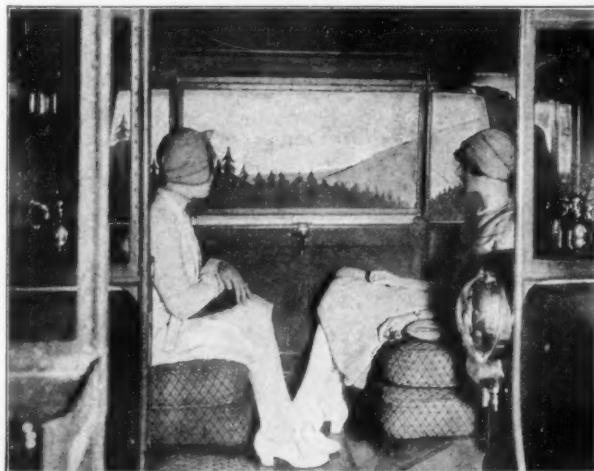
The bus has no hood, so the motor is withdrawn horizontally on a carriage after bolts, gasoline and oil feed lines, and the electric lines, are disconnected



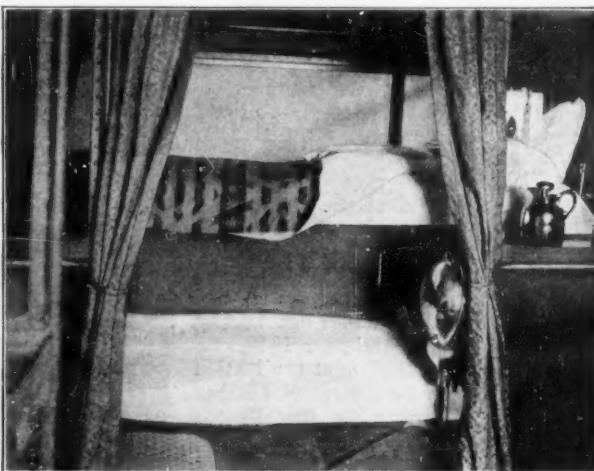
Partially skeletonized, self-explanatory view of the new coach showing the various unique features of its design

has running water, a wash basin, two berths, windows, electric fans and lights, thermos bottle, et cetera, and is six feet four inches from floor to ceiling. A center aisle, located halfway between the upper and lower decks, leads to a lavatory in the rear. The space inside the front door is used as a kitchen when the door is closed. This kitchen is equipped with an electric stove, toaster, coffee urn, and an ice box.

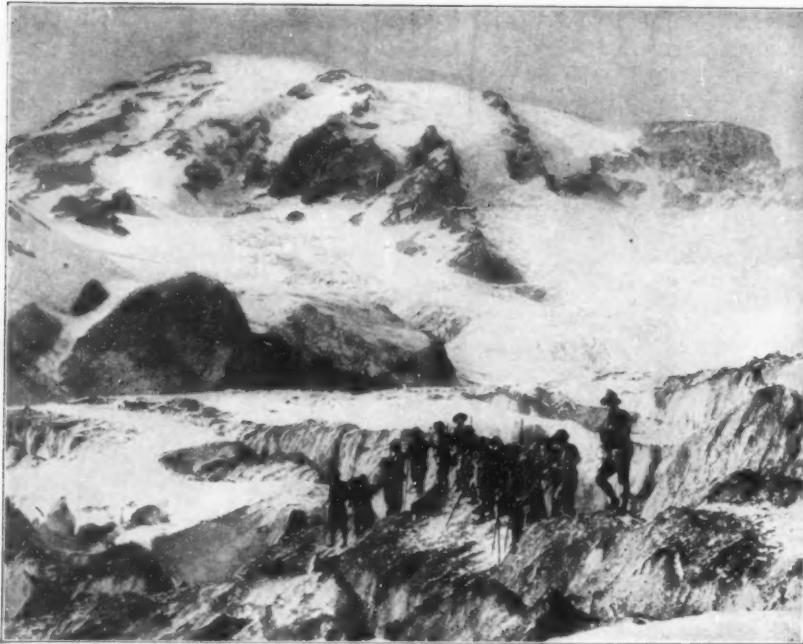
A remarkable feature of the design is the manner in which the 110 horsepower motor may be removed. Spare motors will be stored at all stations along the route, and a new motor may be installed in 20 minutes by loosening the oil, gas, and electric lines and a few bolts. The crew consists of a driver, a chef, and a porter.

**COMPARTMENT DURING THE DAY**

Seating arrangement of a two-person compartment. Just inside the door at the right is shown the basin which turns upward on a hinge

**BEDS PREPARED FOR THE NIGHT**

Heavy sliding curtains give privacy to each compartment at night. Besides other equipment, each has space for luggage and for the clothes



NISQUALLY GLACIER, MOUNT RAINIER

*Visitors in rapidly increasing numbers are taking advantage of the winter sports and the opportunity to climb real, "live" glaciers afforded by this snow-clad mountain that rivals the Alps*

## Up Snow-clad Peaks

### Climbing a Mountain of the Rockies Where Glaciers Are Plentiful

By HERBERT OTIS WARREN

MOUNT RAINIER, in the western part of the state of Washington, lies about 40 miles south-west of Tacoma, and forms part of the great Pacific Coast drainage system. With 48 square miles of glaciers, an expanse of ice far exceeding that of any other single peak in the United States, Rainier even surpasses in magnitude and splendor some of the famed glaciers of Switzerland. Soaring 14,408 feet into the air, the gigantic proportions of the peak seem to dwarf mountains more than 6000 feet in height around the base—and the eminence covers 100 square miles of territory, or one third of the area of the Rainier National Park.

Mount Rainier is now an extinct volcano. Indian legends tell of a great eruption many years ago, but on record there actually are four noteworthy outbursts—one in the year 1843, one in 1854, one in 1858, and the last in 1870. There is no danger of another outburst, according to the United States Geological Survey, but there is evidence of hot springs at the foot of the mountain and there are also jets of steam near the summit which melt holes in the snow and ice.

The life history of Mount Rainier has been a varied one. Like all volcanoes,

it has built up its cone with the materials ejected by its own eruptions—with cinders, steam-shredded particles, lumps of lava, and with occasional flows of liquid lava that have solidified into layers of hard, basaltic rock. The steep inclination of the lava and cinder layers visible in its flanks has led geologists to believe that at one time the mountain must have approached a height of 16,000 feet—an explosion that followed reducing the height by some 2000 feet to its present measurement. Two small cinder cones later filled this cavity, which measured nearly three miles across from north to south. Ensuing eruptions gradually added to the height of the cones until finally a low rounded dome was formed, this being the present summit.

EXTENDING from the summit there are great ice streams, four to six miles in length, cascading into the rivers below. Six massive glaciers appear to originate from the very summit: the Nisqually, the Ingraham, the Emmons, the Winthrop, the Tahoma, and the Kautz glaciers. Such glaciers as the Cowlitz, the Pyramid, and the Paradise, while of enormous size, are born of snows in rock pockets or *cirques*—deep bowls sculptured from the ice—and finally merge into the glistening armor of the volcano.

In all there are 28 glaciers on Mount Rainier, seven of them being "live," or moving, glaciers which originate in the summit snows and move down its slopes in their separate canyons, at the rate of from 16 to 20 inches a day.

Through 14 valleys these rivers of ice flow in paths self-carved. Just as water flows, these ice packed masses



AN ICE CAVE IN PARADISE GLACIER

*Hot springs, jets of steam, and warm air currents, singly or together, melt huge caverns under the ice. In the foreground will be noted a rushing icy stream which helps to keep this cave open*

turn and twist on their downward path, avoiding the harder rock strata, until they reach the lower altitudes where the warmth turns them into rivers of water.

The ascent of Mount Rainier is usually made from Paradise Valley, over the Gibraltar route, and should be taken under the leadership of a competent guide. Before the start, the necessary equipment for the long hike, such as alpenstocks, amber glasses, hobnails and calks for boots, khaki breeches, et cetera, can be secured at nominal rental fees. Actor's face paint is also necessary to protect the face from sunburn.

**T**HE party leaves the valley in the afternoon in order to reach Camp Muir before dark. Here, the Government has erected a stone shelter cabin which protects the climber from storm and wind. With blankets also provided, a good night's rest may be had before continuing the climb early next morning.

Cowlitz Cleaver, a narrow spur of rock, is a difficult ascent and it is not until about eight o'clock that the base of Gibraltar Rock is reached. The way now leads over a narrow ledge on the face of the cliff, part of the way overhung by icicles and rock masses. This tiny ledge leads to the base of a narrow chute between the ice of the upper Nisqually Glacier and the body of Gibraltar. By aid of ropes suspended



NEAR THE SUMMIT

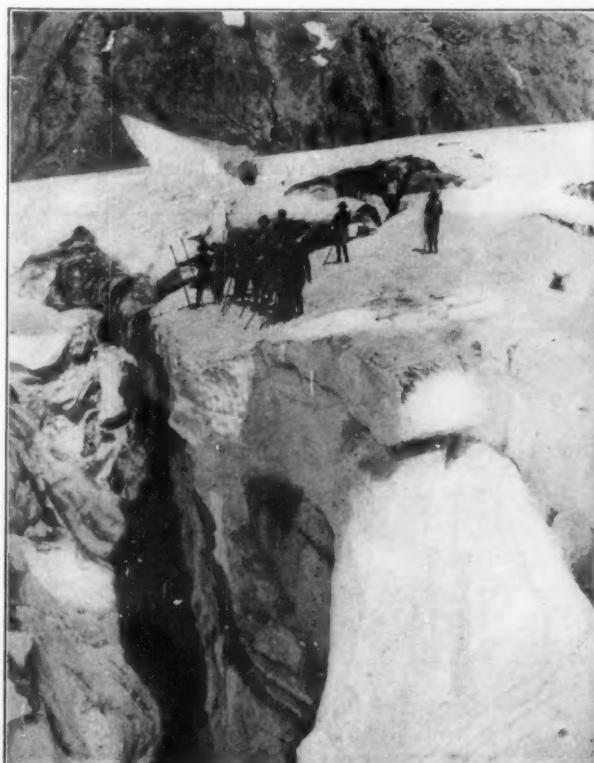
*Climbers with guides ascending Mount Rainier. The ladder used is carried along in sections that are easily joined together*

from the cliffs this arduous passage is made, one person climbing upward at a time to avoid slides of ice and rock debris. Gibraltar, 12,679 feet high, is reached about 10 o'clock, and there

now remains a long snow slope to climb. One hour later, the rim of the south crater is reached. This rim is always bare of snow, but the crater itself is perpetually snow-filled. It may be traversed without risk if the edge is not approached, for the snow is there melted out in caverns by the steam jets. Columbia Crest, the pinnacle of the peak, is just beyond, but out of a party of say, 20 climbers, perhaps 15 will be able to make the final climb, the rest being too exhausted to accomplish the strenuous task. As a usual thing, tourists are content to explore the ice caves and climb the smaller peaks.

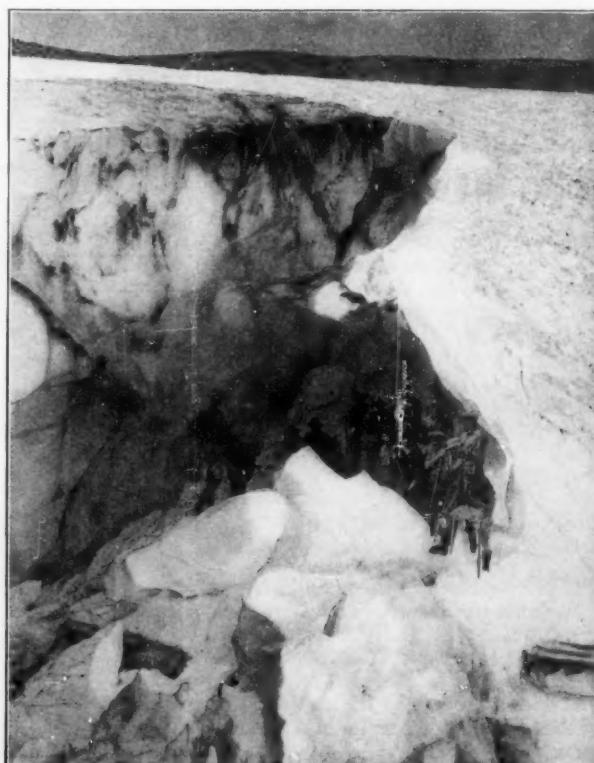
**T**HREE are certain well-known rules of mountaineers which, when adhered to, make the ascent of Mount Rainier comparatively easy. First of all the over-ambitious should curb their desire to start immediately for the summit; they should first practice on the shorter hikes, and in this way become accustomed to the higher altitude and toughen their muscles for the longer climb. Moderation in diet and the avoidance of heavy food of all kinds are precautions that cannot be too strongly recommended for those attempting to make the ascent.

**Q**Perhaps you've never heard of the plant whose seeds bore their way into the earth like a brace and bit. Then you will be interested in the coming article describing this marvel of nature.



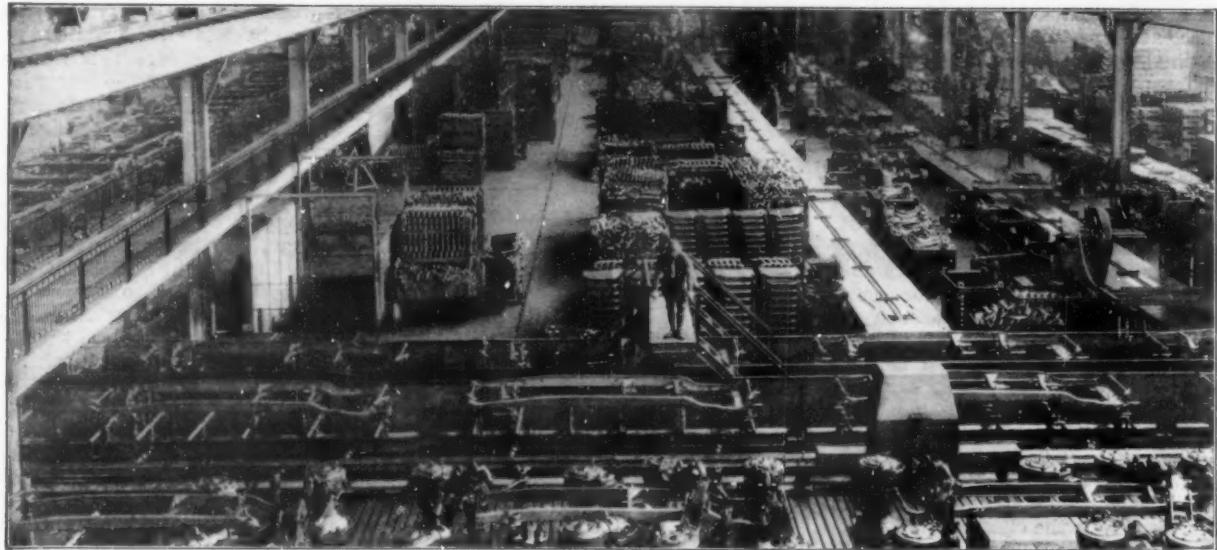
A DANGEROUS GLACIAL CREVASSE

*A party on Nisqually Glacier, 45 minutes walk from Paradise Inn. Parties visiting the glaciers are under the direction of competent guides*



TUMBLED HEAPS OF ICE

*A hike of an hour brings the climbing party to scenes such as this. All are equipped with alpenstocks, darkened glasses, and warm clothes*



THE FINAL ASSEMBLY

Various machining operations are carried out on the left side and right side members as they come from the rear on parallel conveyors, together

with the cross bars. These sub-assemblies transfer to the transverse machine in the foreground where they are clamped together and riveted

## One Machine Fills a Huge Plant

*Greatest Automatic Machine in the Automotive Industry Receives and Inspects Strip Steel and Turns Out Completed Frames Almost Untouched by Human Hands*

**C**HARACTERIZED as one of the most romantic accomplishments of the modern industrial era, the plant of the A. O. Smith Corporation for making automobile frames is virtually one huge automatic machine which receives and inspects strip steel and manufactures a completed enameled frame in less than two hours.

Except for minor operations such as pickling, cleaning, and oiling the stock, and inspecting the assembled frame, the automatic machine takes care of all operations and the unit being manufactured is not touched by human hands, each frame remaining on conveyors 90 percent of the time. There are 552 operations on each frame, and since the plant has a capacity of 7000 frames daily, the daily operations performed by the machinery total 4,000,000. The plant is 600 feet by 212 feet.

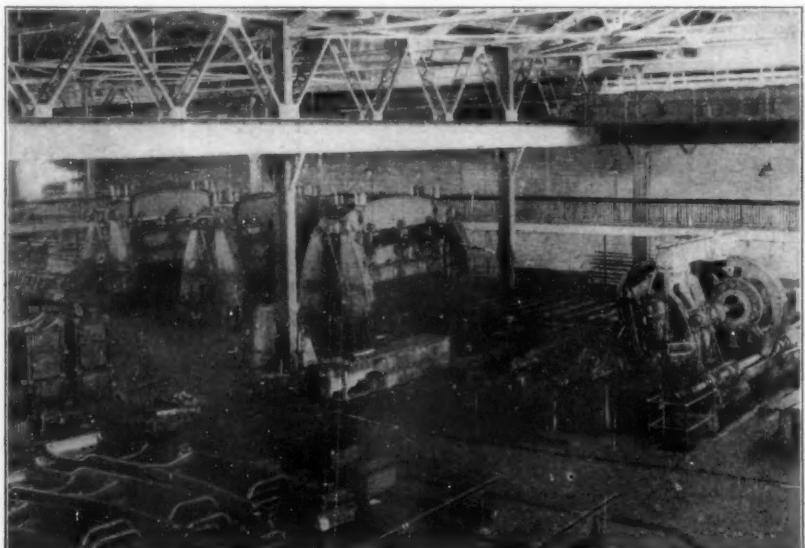
**T**HE first unit in the manufacturing line is the inspection machine. This machine automatically rolls the strip steel to remove curvature, measures it for thickness, length, and width, and automatically stacks it in piles. Rejections are thrown aside in a separate pile.

A monorail crane then carries the steel to the pickling department which consists of crates made of acid-resisting

metal, each of which has a capacity of about five tons. These crates pass through the acid and alkali tanks and then through the oil tanks to give a protecting coat of oil.

From this point the steel is automatically carried to the side bar manu-

facturing line where the sequence of operations is: (1) offsetting strips for vertical bends in the frame; (2) piercing left hand strips; (3) piercing right hand strips; (4) blanking both sides; (5) forming the left hand blanks; and (6) forming the right hand blanks.



STARTING THE SIDE BARS

Here the strip steel is blanked, pierced, formed, and offset to give what is called the "kick-off" over the rear axle and the front and rear drops. There are six of these presses at starting end

The left hand and right hand members are offset alike and are carried along the line to the piercing presses. Locating notches to secure accurate registering in the blanking presses are also made on the piercing presses.

After the side members have passed through the blanking machine, they are carried down the conveyor and transferred to the forming press which forms first the left hand and then the right hand members by means of fingers which are almost human in their action.

All side members are then transferred to the side-member assembling line. Here they are loaded automatically in pairs on trucks which are carried by a reciprocating conveyor down the line. This line, approximately 400 feet long, stops at 19 stations, at each of which several machines are at work pinning and riveting brackets in place to complete the side member sub-assemblies.

**S**INCE side members are handled in pairs and the cross members individually, four manufacturing lines, each with a capacity of 450 cross members per hour, are necessary to keep step with the two side member lines.

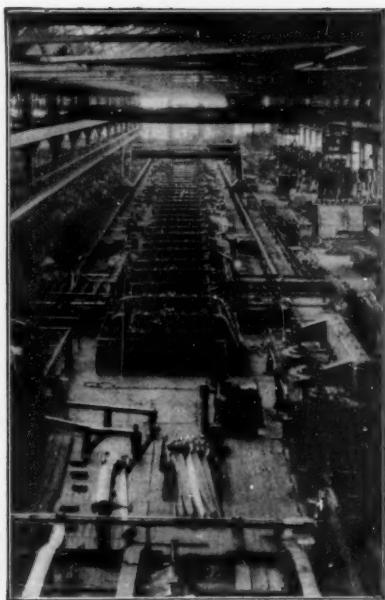
In the four lines which fabricate the cross members there are blanking presses which also pierce holes, drawing presses which form the end laps as well as the channel or other section as required, automatic drilling machines, and riveting presses.

When the side and cross members have been fabricated they are carried by conveyors to the final assembly line. Here they are picked up automatically, fastened together in proper relationship to each other, and automatically riveted. The rivets used in this operation are fed into tubes below the assembly lines and carried by compressed air to the riveting guns. Approximately 90 rivets are placed in about 10 seconds, the final heading being done on another machine

equipped with jaws variously shaped to operate in any position desired.

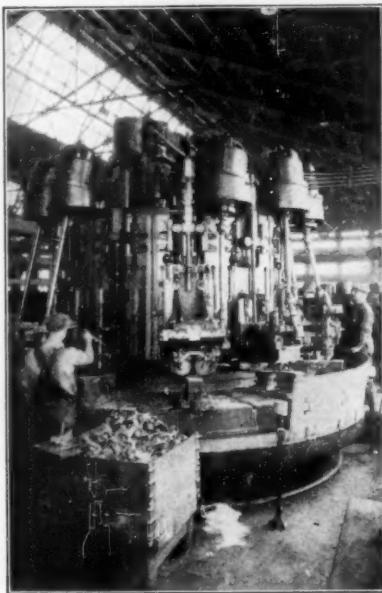
At this point the assembled frame is checked by inspectors for alignment and proper location of the various holes and locating points. Following the inspection, the frames go to the automatic washing and enameling unit. Here they are cleaned, dried, and then discharged by gravity to the loading station of the painting machine where they are coated with a high-temperature baking enamel. A conveyor chain, about 700 feet long, carries the frames through a two-story oven in which they are baked for one hour.

The one link remaining is that of storage. Since shipping schedules could not possibly be arranged to move continuously the enormous production



THE 19-STATION LINE

*Various machining operations for side members are performed on these parallel ways. Assembly is completed at the far end*

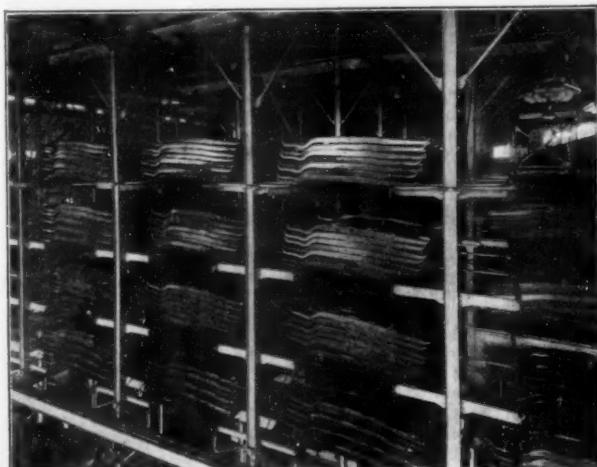


SPRING-HANGER MACHINE

*Special machines for making small parts are distributed along the sub-assembly line*

of this plant, adequate storage space is necessary. Therefore the plant is equipped with a storage house 335 feet by 216 feet. In this building monorail crane systems are provided on two levels to transfer bundles of frames to the racks specially designed for this purpose. Besides the indoor storage there is a supplementary storage yard outside the building which is served by means of swinging cranes.

Besides being spectacular in its performance, this plant is said to be a commercial success. It is said that the number of men employed to supervise the automatic equipment—about 200—is less than one fifth the number necessary for a semi-automatic plant having an equal production capacity.



STORAGE BUILDING

*At the upper right may be seen the traveling monorail crane which can be run over any aisle to deposit frames on the extended brackets*



STORAGE YARD

*Outdoor storage of frames ready for shipment. A vast amount of space is necessary to store temporarily the large production of this plant*

# Inventions for the Household

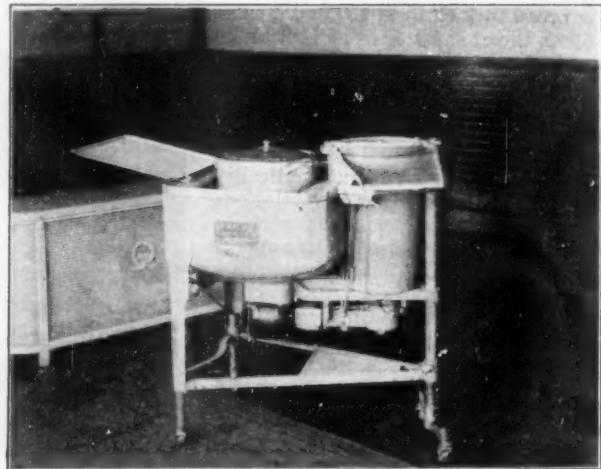
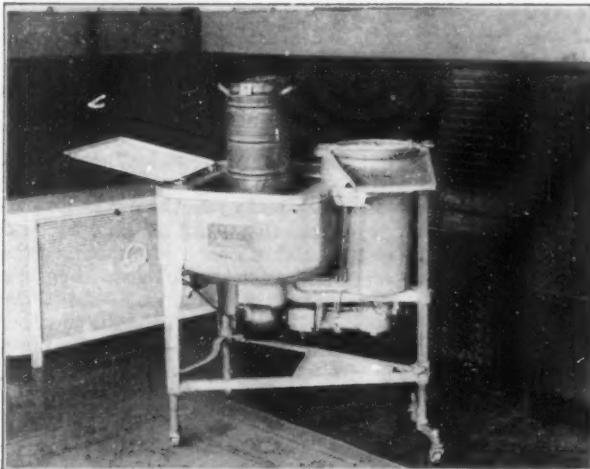
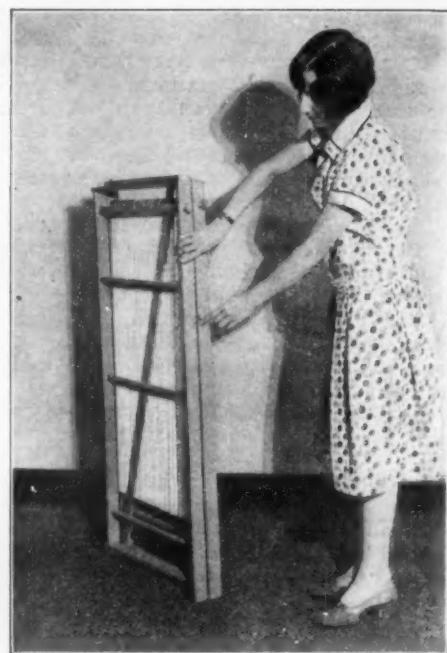


## SALT AND PEPPER SHAKER

This duplex salt and pepper shaker of glass has a sliding top which normally covers both salt and pepper but can be slid over to the left or right to expose either.—*Better Sales Company, 112 Market St., San Francisco*

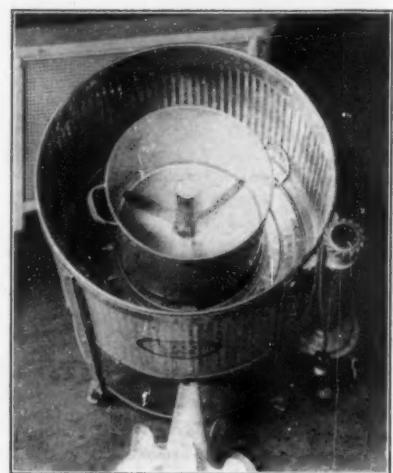
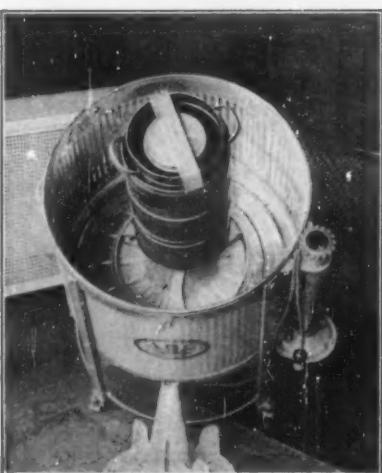
## ◀ INDOOR FOLDING CLOTHES RACK ▶

A floor area of only 20 by 36 inches is equivalent to 75 feet of drying space when this folding rack is used. When folded, it takes up no more room than an ironing board. It weighs only 15 pounds, but is large enough for the largest sheet. Clothes hang over wooden rods so they will not be line-marked or otherwise soiled. Useful in apartments away from outdoors grime.—*Handy-Ann Co., Portland, Ore.*



## ICE CREAM FREEZER AND CHURN

The two photographs at the left show a new freezer designed to operate in a washing machine. The illustrations at the right show a churn that is similarly operated. (Freezer and churn are shown in two different types of washing machine.) In the freezer, an adjustable friction disk in the top cross-arm holds the dasher in place while the can turns on a bronze shaft that extends up through the ice chamber. This shaft is connected to the center post of the washing machine. An outside can surrounds the ice chamber and catches the overflow; no salt water can come in contact with the washing machine. The churn has a post in the center which fits down over the center post of the washing machine. Its operation is similar to that of the freezer. City dwellers can always have fresh butter by buying whole milk and churning it themselves.—*Cole Manufacturing Company, Birmingham, Ala.*

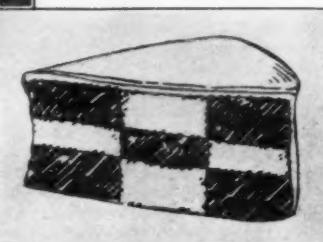




UNIQUE CAKE PAN

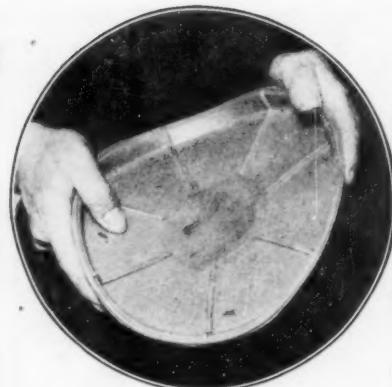
▲ ▶

To make a cake like the checkerboard slice at the right, drop the center section, consisting of two concentric rings, into the large pan; pour different colored cake batter into the three rings; and bake in usual way. Arrange the layers properly and you have it.—*Lewis and Conger, 45th St. at Sixth Ave., New York*



◀ CLOTHES HANGER

The distinctive feature of this new clothes hanger from France is that it carries its own protection against moths. Underneath each arm a recess is cut to receive moth balls in a special flat wafer shape. Over each of these there is a perforated metal guard which swings open for inserting fresh wafers and snaps tightly closed.—*Lewis and Conger, 45th St. at Sixth Ave., New York*



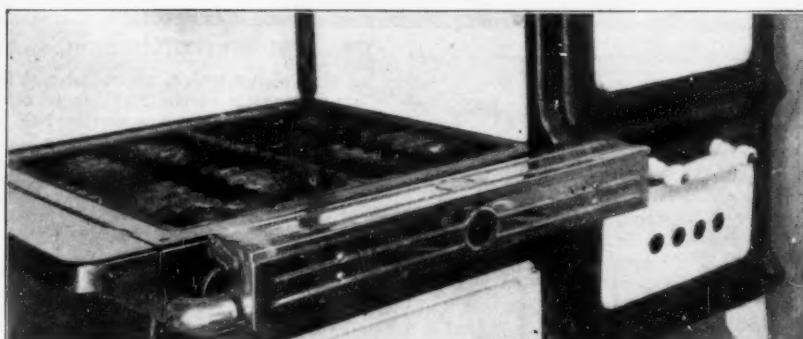
CLOTHES SPRINKLER

This simple device is almost an instance of the turning of swords into ploughshares for it is being made in Germany with the same machinery used during the war to make shells. Made of thin aluminum, it holds about a pint of water.—*Lewis and Conger, 45th St. at Sixth Ave., New York*



TABLE ELECTRIC FAN

Attractive as well as practical, this new fan represents a radical departure from existing standards. The fan turns in a horizontal plane, well protected by the filigree guard, and throws a current of air upward against the deflector which, in turn, throws it outward without creating a direct draft. The top may be used as a container for fruits, flowers, or any variety of ornaments.—*Electro Dental Manufacturing Co., Philadelphia, Pennsylvania*



GAS RANGE LOCK

In a home where there are children, this lock is almost a necessity. The gas cocks are enclosed in a metal housing which is easily manipulated but which eliminates the danger of accidental opening of the cocks by children or a loose apron string.—*Rolland and Neubarth, 202 Barton St., Flint, Mich.*

◀ CORK-BACK BRUSH ▶

The bristles of this brush are mounted in a solid piece of cork. It will float on top of the water and the back will not crack from constant soaking. For this reason, it should outwear some wooden brushes.—*Marshall Field Co., Chicago*





ALL METAL GUITARS

The instruments shown here are made of 22 gage German silver and use a new principle of sound production. Contrary to the popular belief that two resonators will resonate more than one, two of the circular amplifiers are placed on the treble side and only one on the base side when the base tones are to be emphasized.—*Sherman Clay and Company, 536 Mission St., San Francisco*

## Inventions New and Interesting



MARCEL WAVER

With this iron, models of which are made to be heated electrically or on a stove, marcel waves are made by a lever attachment that pushes forward or backward in the groove to curve the wave to front or rear.—*The Marcel Waver Company, Los Angeles*



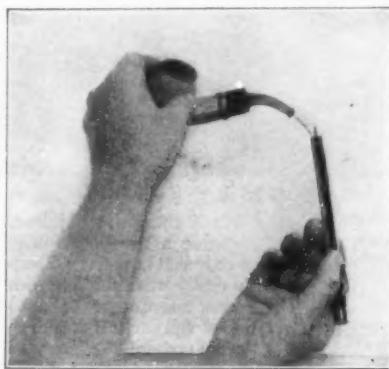
TYPEWRITER ANCHOR, SILENCER, AND SHOCK ABSORBER

A new clamp which, when fastened to the typewriter with two screws, allows quick transfer of the machine to other desks yet always anchors it securely. At the left is shown a typewriter held in place by two of these clamps and at the right is a close-up.—*The Lin-May Company, 111 W. Jackson Boulevard, Chicago*



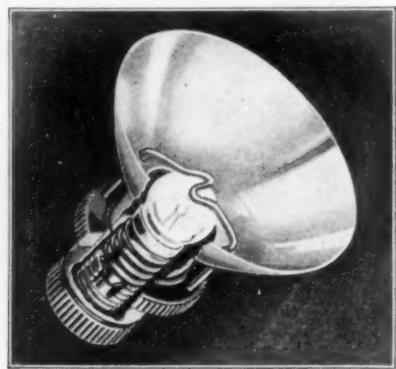
RACKET CHAIR

Embodying the principle of snow-shoe manufacture, this canoe chair was designed by a Maine woods guide. It weighs four and a half pounds and is made of white ash, spruce, and selected rawhide.—*Kabin-Kraft Service, Augusta, Maine*



PIPE CLEANER

This nickel-plated cleaner resembles a fountain pen and may be carried in the pocket. A spiral wire, which is extended by a sliding button, cleans any stem, curved or straight. A heavier rod cleans the bowl.—*Costick Products Co., 400 W. 23rd St., New York*



MINER'S SAFE FLASHLIGHT

The lamp holding mechanism of a flashlight designed to prevent explosions when a lamp shatters in an atmosphere of gas. When the bulb breaks, base is hurled out, and current is cut off.—*National Carbon Co., Inc., 30 E. 42nd St., New York*



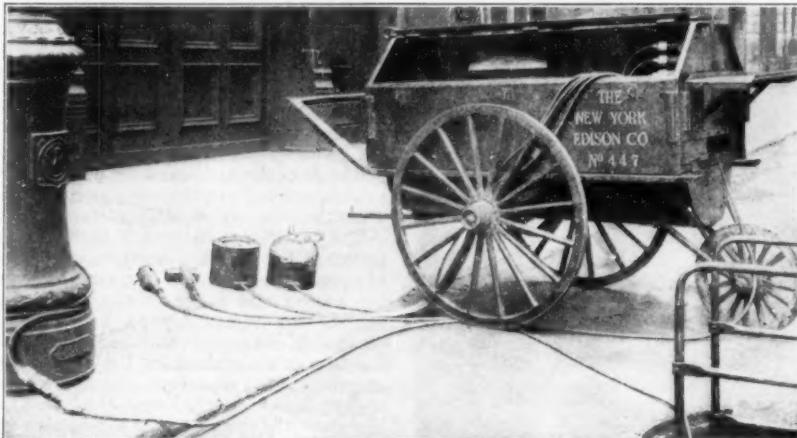
◀ MASSAGING MACHINE

The four soft rubber pads of this device are agitated by a small electric motor, their movement being such as to thoroughly knead the scalp, induce better circulation, make the scalp healthy and promote hair growth.—*Blud-Rub Mfg. Co., 730 E Washington St., Indianapolis, Ind.*



▲ HANDY LABEL ROLL

This helpful little device consists of a conveniently shaped, hand fitting metal container, filled with a roll of gummed tape. A slight thumb movement slides the tape out perfectly flat, a metal edge being provided for detaching sections.—*Handy Roll Co., Fruitvale, Oakland, Cal.*



▲ ELECTRICITY USED IN CABLE SPLICING

Here are shown a solder pot, compound kettle, soldering iron, and portable lamp—all electrically operated—ready for use in splicing cables in manholes.—*New York Edison Co., 130 East 15th St., New York*



FERTILIZER SPREADER

This spreader has been designed to make possible the even spreading of fertilizer, lime, or gypsum over the lawn. It removes the danger of burned-out grass due to uneven spreading by hand. For spreading fertilizer or sowing grass seed, the device is operated like a lawn roller.—*Standard Equipment Co., 965 Second Ave., W., Cedar Rapids, Iowa*



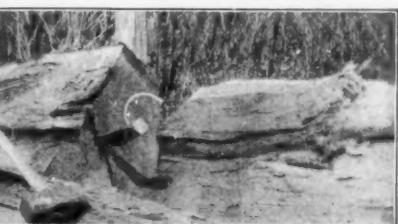
EXPLODING TIMBER-SPLITTING WEDGE

Black powder is first poured into the chamber in the wedge blade; the wedge is then driven into the timber; the fuse is lighted; and the explosion that results, blows the log apart.—*Hutchinson Mfg. Co., 7721 Susquehanna St., Pittsburgh, Penna.*



CHILD'S SUN-BATH SUIT

This photograph shows one of a number of styles in summer clothing for small children that have been designed by the Bureau of Home Economics, Department of Agriculture, and announced in a recent bulletin. Besides being loose and comfortable, these suits allow penetration of the beneficial sun rays. Bulletin is sold by: Superintendent of Documents, Washington, D. C.



# The Scientific American Digest

## *A Review of the Newest Developments in Science, Industry and Engineering*

### **Lincoln Highway Signed with Concrete Posts**

DURING the past summer, the Lincoln Highway, stretching from east to west across the country, was re-marked by concrete posts of an entirely new and unique design. On the side of these posts facing the motorist, there appears an arrow, cast of blue concrete, directing the driver to proceed straight ahead or turn to the left or right.

On the face of these markers, there are the familiar Lincoln Highway red, white, and blue bars, each being cast in colored concrete, while above this there is a bronze medallion of Lincoln set into the concrete. This medallion, which is four inches in diameter and somewhat similar to a coin in arrangement, bears the inscription: "This highway dedicated to Abraham Lincoln."

The plan to mark the highway in this manner has been under consideration for several years, but the initial cost prevented until two sponsors of the Lincoln Highway—Willys-Overland and General Motors—both of whom have contributed to road building in the far west, offered to finance this new venture. It is believed such markers will eventually supplant present methods, all of which require a heavy expense in maintenance.

The Lincoln Highway posts, being made of two imperishable substances, concrete and bronze, are expected to last indefinitely and will require no maintenance.

### **Locomotive Has Front End Cab**

MANY horses win races only because their shoes have the right shape and weight. Railroads have found that some of their "iron horses" can win the race against large operating costs by making a few changes in the construction of their locomotives.

The Southern Pacific, which maintains at Sacramento, California, one of the largest railroad shops west of the Mississippi, recently re-modeled one of its locomotives in order to improve its efficiency by increasing

its tractive power from 85,040 pounds to 105,340 pounds. This remodeled locomotive is now undergoing test.

The Southern Pacific's Overland Route is the shortest of the main transcontinental rail arteries connecting the large productive regions of the Pacific Coast with eastern markets. From San Francisco Bay it travels northeasterly through the valley of the Sacramento and then climbs easterly across the Sierra mountains toward Reno and the east. The climb over the mountains is a gentle but continuous grade. To

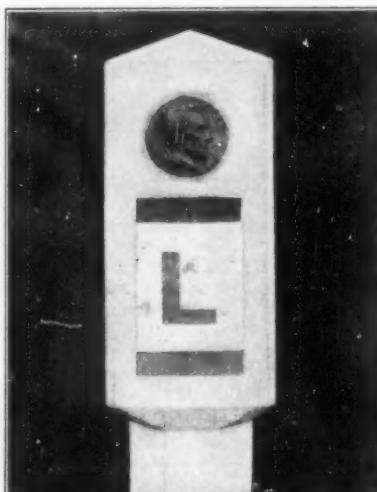
tions, found satisfactory for the type of service they were assigned to. These exceptions were that the locomotives in traveling down grade could not "drift" but had to "roll" under steam pressure. Another exception was that they could not travel fast enough for the service required. These two factors counted greatly against their operating efficiency. The company therefore made a study to determine how the locomotives could be rebuilt to eliminate these factors.

Last March the company released from its Sacramento shops locomotive C. P. 4028, the first of seven similar Mallets to be rebuilt. This locomotive had two high pressure cylinders with 26-inch diameter by 30-inch stroke, and two low pressure cylinders with 40-inch diameter by 30-inch stroke, giving a tractive effort of 85,040 pounds.

In the shops four new high pressure cylinders of 22-inch diameter and 30-inch stroke were built in the locomotive to give a tractive effort of 90,940 pounds.

The boiler was heretofore built in two sections—the forward section consisting of a preheater and smoke box, and the back, the firebox and boiler proper. The preheater was removed, the boiler being made all in one section, and the same overall length was maintained by the application of a combustion chamber to the firebox and slightly increasing the length of tubes. This improved the design to the extent that its evaporating capacity was increased about 16 percent. A front end throttle was installed in the smoke box, which location, in addition to supplying super-heated steam to the auxiliaries, has the advantage of giving the engineer better control in handling the locomotive, thus enabling him to prevent unnecessary slipping of the drivers. A type "E" superheater, open type feed-water heater and two mechanical lubricators were also installed.

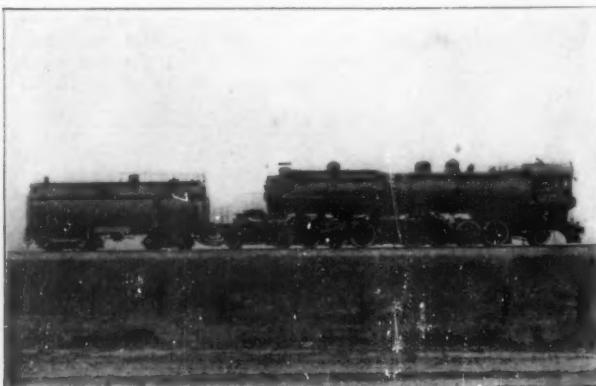
The cab fixtures were rearranged to give enginemen a better view of the gages, and a new design throttle rigging was applied, giving easier control. In general, this



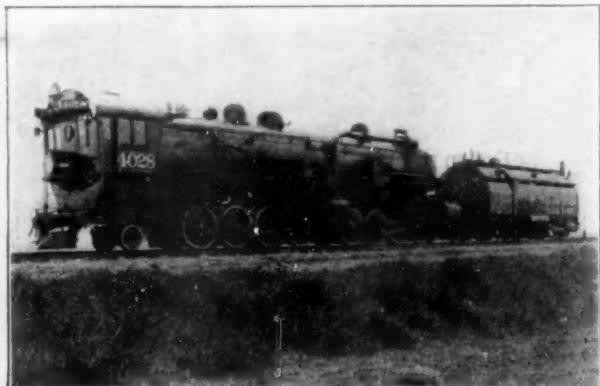
The symbol familiar to travelers on the Lincoln Highway as it now appears. It is built of concrete

facilitate the heavy perishable traffic over the Overland Route, the company placed in service a number of "articulated compound Mallet consolidation" locomotives to operate between Sacramento, California, and Sparks, Nevada.

After a study of their operation over a period of time they were, with some exceptions,



The Southern Pacific's locomotive that seems to run backwards. Note the eight powerful driving wheels on this side and the booster under rear end of the tender



Front end view of the locomotive that was rebuilt to give it greater traction. It is not a Mallet type so it has been called the "articulated consolidation" engine

arrangement provides more room in the cab which is now mounted on the forward end of the locomotive.

The water capacity of the tender was increased from 9800 to 12,000 gallons and oil capacity from 3112 to 3771 gallons.

A new front truck having greater capacity and larger journals was installed on tender and an auxiliary locomotive or booster was installed under rear of tender. This booster develops a tractive power of approximately 14,400 pounds in addition to that developed in the locomotive cylinders. The remodeled locomotive cannot now be called a Mallet as the name refers to a system of compounding an articulated engine first proposed by Anatole Mallet. It is, therefore, now called an "articulated consolidation" locomotive. Its efficiency is being tested by a dynamometer car.

#### Natural Lightning Writes Its Own Record

**N**NATURAL lightning, untamed and destructive electricity that is measured in millions of horsepower and millions of a second, has been made to write a record of itself. In the foothills of the Allegheny mountains near Lake Wallenpaupack, Pennsylvania, where engineers of the General Electric Company have been cooperating in experiments and investigations of the 220,000-volt transmission lines of the Pennsylvania Power and Light system for more than three years in an endeavor to ascertain the characteristics of lightning, the greatest enemy of high voltage transmission lines, a photographic record has been obtained showing the nature of a lightning stroke on transmission wires before reaching the ground. This is the first 220,000-volt line ever built in a lightning-infested territory, and the first in the world outside of California.

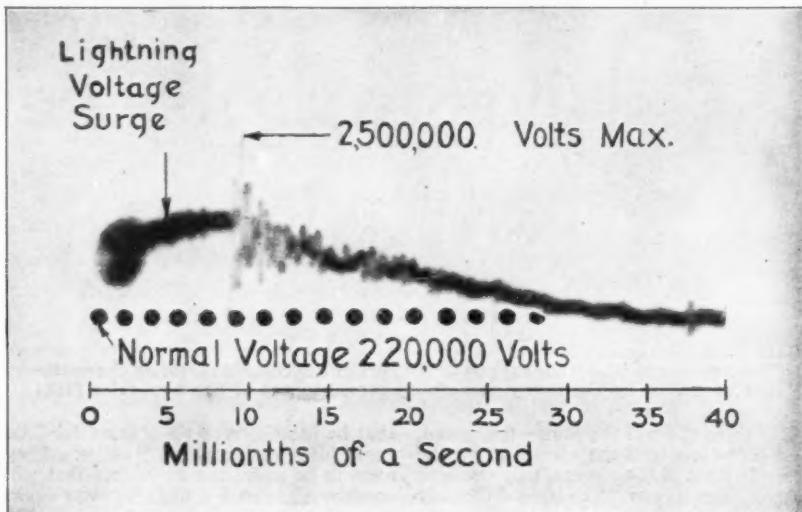
The accompanying picture, the first of its kind ever made in the world, reveals a stroke on the transmission wires of approximately 2,500,000 volts. It was made automatically by a portable cathode-ray oscillosograph. This device can record what happens in a millionth of a second, or even a fraction of such a brief interval.

The General Electric Company, in cooperation with the Pennsylvania Power and Light Company, the Philadelphia Electric Company and the Public Service Electric and Gas Company, of New Jersey, began this study of natural lightning on transmission lines in 1925. The cathode-

ray oscillosograph had not been developed at that time and various types of surge recorders were used. Early this summer, engineers of the above mentioned companies, with Mr. Peek, who is credited with having done more experimenting with artificial lightning than any other engineer and

Peek, Jr., in a paper presented before the Franklin Institute in Philadelphia in September, 1924, based on his many years of experimenting with artificial lightning.

This field laboratory was planned with the expectation of continued observations on natural lightning, with the realization



The record written by a stroke of natural lightning by means of the cathode-ray high-speed camera. Note the maximum surge at 10 millionths of a second

who recently announced an artificial flash of more than 3,500,000 volts, made an inspection of the 65-mile, 220,000-volt transmission lines extending from Wallenpaupack to Siegfried, and selected a location for the experimental laboratory.

Less than a week after the cathode-ray high-speed camera had been put in working order, the awaited thunderstorm arrived and the picture was taken. The negative showed that before five millionths of a second had passed the voltage wave had climbed to more than 1,500,000 volts. A local disturbance, due to an induction flash-over and reflection, caused a rise to 2,500,000 volts in a fraction of a millionth of a second. This splash or ripple then died down in a millionth of a second and the wave passed to below dangerous value in about 10 millionths of a second and then to zero.

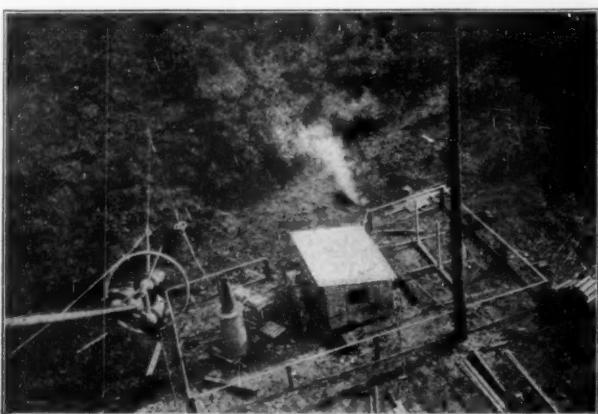
This particular picture is especially interesting since it shows characteristics closely in line with predictions made by F. W.

that a great deal of data will be required for practical solution of lightning control on transmission systems.

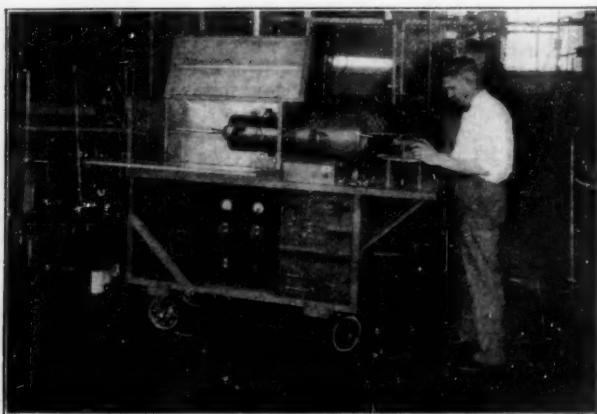
#### Color "Movies" for Amateurs

**T**HE Eastman Kodak Research Laboratories, under the direction of Dr. C. E. K. Mees, have been working for a number of years to perfect color movies. The most radically new element in the process is the film. Instead of having the usual smooth surface, the side opposite the sensitive coating is embossed with cylindrical lenses so minute as to be invisible. These lenses, which are part of the film itself and made of the film substance, would each look, vastly magnified, like a rib of a corrugated iron roof. They run lengthwise of the film and 559 of them occupies an inch.

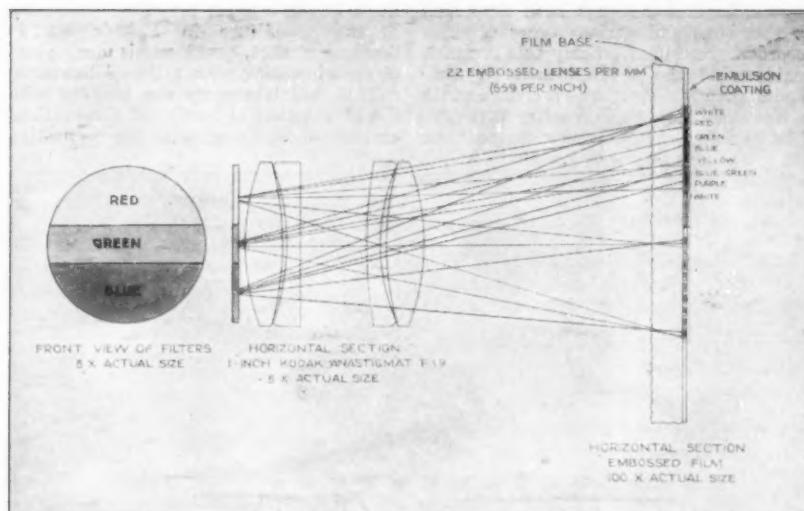
The effect of these invisibly small lenses is to separate the rays of light which come through the three segments of a three-colored "light filter" into the camera. Each



View of the exterior of the small building near Lake Wallenpaupack, Pennsylvania, where the first record of a natural lightning stroke was obtained by engineers



The cathode-ray oscilloscope opened to show tube and camera. General Electric Company engineers are using this equipment to learn secrets of natural lightning



The manner in which the rays from the three filter colors are laid on the sensitive emulsion by the many minute embossed lenses of the new color films

of the three colors of the filter—red, green, and blue—lets into the camera, from the scene in front of the camera, only the light rays of its own color. The three differently colored light rays register on the film only as black and white; but each tiny lens embossed on the film so distributes the light rays falling upon it that the different colors register on the sensitive film emulsion as a

that he has observed these beautiful little game birds eating potato beetles. They seem to be about the only birds that will condescend to such a diet, for even ducks and guinea fowl, which will ordinarily eat anything they can get into their beaks, refuse to touch them.—*Science Service*.

#### A Power House on Stilts

**I**N order to avoid shortening the spillway length on dam Number 7 on the Kentucky River, the Kentucky Hydro-Electric Company designed a power house of unusual construction to utilize the normal fall of 15 feet at this point. Of the 14 dams and locks for slack navigation on the Kentucky River, Number 7 is the shortest, with a spillway length of only 340 feet. As a maximum flood stage has been known to give 27 feet of water on the spillway with no fall, it was considered highly undesirable to build a power house directly on the dam.

The high cliff at the end opposite the lock made it impractical to build the power house beyond that abutment. The problem was solved by placing the power house over the dam on stilts, as it were, and above flood level. This left the spillway practically unobstructed.

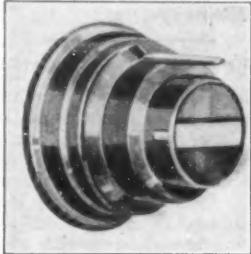
In the power house, which is  $2\frac{1}{4}$  feet by 91 feet, there are three generators with an aggregate capacity of 2000 kilowatts. The three hydraulic turbines driving these generators are installed in pits built with their roofs level with the crest of the dam. Over the wheel pits is a deck which supports the trash rack. Upon this deck, which forms a part of the spillway of the dam, are three piers about 50 feet high, which support the power house. These piers are centered directly over the turbine



Dr. C. E. K. Mees, who has been given credit for new color "movies"

shafts which pass up through the piers into the generator room, being thus protected from floating drift. At the outer, or river, end, the power house has a cantilever extension over the dam while a similar extension at the shore end provides room for the switchboard and auxiliaries.

(Please turn to page 371)



The color filter used in the new Eastman color "movie" process

distinct black and white impression for each color at that point.

The light of the projector then passes through the film in such a way that it shines out through the tiny film lenses, and then through the projector lens; and each ray is directed through the proper color on the light filter, to fall on its proper spot on the screen. The combination of the three colors, red, green, and blue, gives every possible natural color.

The process is first being introduced for the use of amateur photographers.

The most significant thing about the new process is its complete simplicity. The amateur cinematographer's part has been made as easy as taking snapshots. He merely has to insert a "color filter" into his home movie camera and thread his special film. All previous color motion picture processes have entailed highly complicated cameras and finishing methods.

#### Bob White Eats Potato Bugs

**S**MALL boys, getting aching backs and no fun at all hunting potato bugs in the parental potato patch, may well sigh for the company of a few southern quail. N. L. Wiley of Beaufort, North Carolina, states

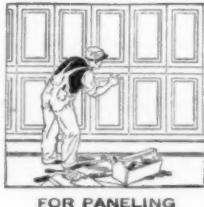


Courtesy Engineering News Record

Power house on the Kentucky River, erected 50 feet above normal water level in order to be above high water and to preserve the full length of the dam

# This genuine wood board is grainless and won't check or split!

*Possesses uniform strength and remarkable workability. Highly resistive to moisture. Very tough and dense. Has a smooth, attractive surface on the face side, and requires no paint for protection. Also takes any finish beautifully. Send for large, free sample.*



FOR PANELING

A decade ago no one ever dreamed that there would be such a thing as *grainless* wood. Yet it has now been on the market for more than two years, and new uses are being discovered for it right along.

The name of this product is Masonite Presdwood. And remember that Presdwood is *all wood*; genuine wood torn apart and put together again.

Presdwood will not crack, check, split or splinter. It shows minimum contraction and expansion under the most severe working conditions. Stoutly resistive to moisture and to sudden changes of temperature, it is practically immune to warping, shrinking, swelling, buckling.

#### *It cannot damage tools*

Presdwood contains no grit, no resin, no foreign matter of any kind. It cannot damage tools. Convenient and easy to handle it also eliminates waste in cutting. And it frequently reduces the number of manufacturing operations.

Presdwood has a very smooth, attractive surface on the face side and requires no paint for protection. It also takes any finish beautifully: lacquer, paint, stain or varnish.

Another one of the outstanding advantages of Masonite Presdwood is that it can be used on any woodworking machinery, and possesses amazing workability. In fact, it is so widely adaptable

that the number and versatility of its uses seem to be unlimited.

These uses include signs, both outside and inside; cutouts of all kinds; breakfast nooks and kitchen cabinets; closet lining and display booths; paneling, interior finish and office partitions; radio boxes; showcases, show window flooring, store fixtures and table tops; bedroom screens and fire screens; toys, tension boards for radio speakers and portable billiard tables; Sager boards for potteries; forms for reinforced concrete; truck bodies; motor boat hulls.

#### *Where next?*

Where will Presdwood be used next? Nobody knows!

Within the past few months it has gone into the making of cooling trays for hot castings, incubators, clothes hampers, work-bench tops, starch trays for candy-making, flower boxes, doll houses and concrete forms.

And just recently it has come into demand for cafe nooks and for the fences of baseball parks! Thus you see that there is really no limit to the uses for Presdwood. Write for a free sample and find out what it will do for you.

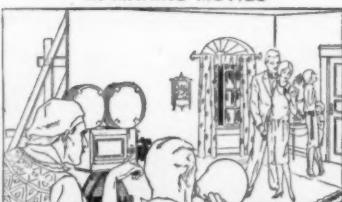
#### MASON FIBRE COMPANY

Sales Offices: Dept. 1610-8, 111 W. Washington Street  
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FOR TENSION BOARDS

IN MAKING MOVIES



Mills: Laurel, Mississippi

**Masonite**  
**PRESDWOOD**  
*Made by the makers of*  
**MASONITE STRUCTURAL INSULATION**

IN BUILDING BOATS



# Learning to Use Our Wings

*This Department Will Keep Our Readers Informed of the Latest Facts About Airplanes and Airships*

CONDUCTED BY ALEXANDER KLEMIN

In charge, Daniel Guggenheim School of Aeronautics, New York City

## Intercollegiate Flying Contests

GROVER C. LOENING, the well-known airplane designer, has given a sum of 5000 dollars for an Intercollegiate Flying Trophy. The first contest will be

particularly among University students.

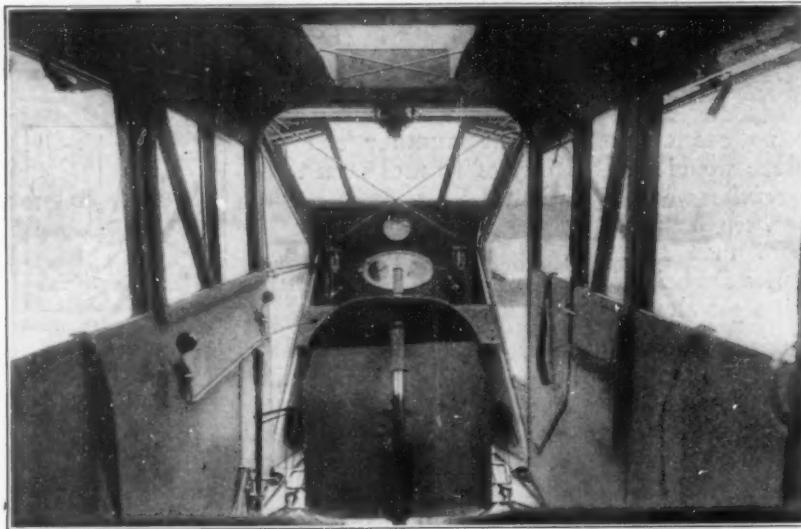
The Flying Club of New York University is particularly fortunate in having secured the loan of a Curtiss *Robin*. The planes must be powered with an OX-5, 90-horse-

airfoil section. Thus they are not simply resistance producing elements, but themselves contribute to the lift of the wings.

## Popularizing the Glider

THE history of gliding in the United States is mainly a record of the scientific work of the great pioneers, Montgomery, Chanute, and Wilbur and Orville Wright. The famous English pioneers of the first half of the Nineteenth Century made valuable theoretical investigations and many flights with powered models. They may be said to have "invented" the airplane.

But the airplane would never have been



Looking forward in cabin of Curtiss *Robin*. Note the clear vision possible

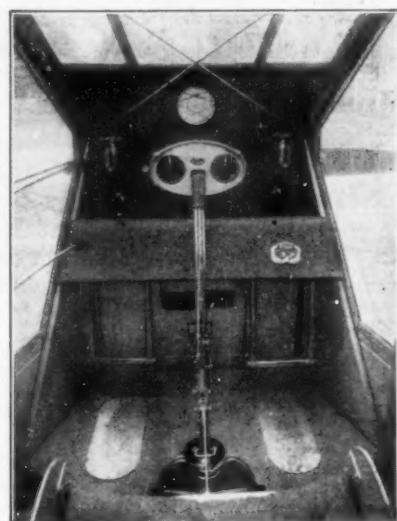
held at Mitchel Field, Long Island. Student teams from colleges and technical schools must include three men who hold Department of Commerce licenses. Each

power engine, and the *Robin* is the most modern plane designed around this engine.

In the old days a Curtiss Jenny with an OX motor, with open cockpit, and carrying but a pilot and one passenger, was regarded as an efficient ship, when its maximum speed was only 73 miles an hour.

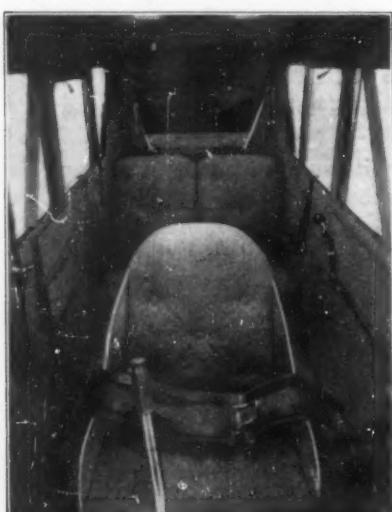
The *Robin*, in spite of its relatively small power, is a three-place, cabin plane, having a maximum speed of nearly 100 miles an hour, with a cruising speed range of 785 miles, and a service ceiling of 12,800 feet.

The bracing structure of the plane is particularly neat. The no-axle chassis is hinged at the bottom of the fuselage. The telescopic member runs up to the front wing-struts, providing a wide tread with the lightest possible landing gear. The struts supporting the wing are wide, and of



Instrument board and controls in pilot's cockpit of the *Robin* plane

reduced to practice without the hazardous experimental work of the glider exponents. The earliest, authentic, man-carrying gliders were built by a French sailor, Captain Le Bris, who, without much scientific training but with wonderful instinct, performed some wonderful glides in the



Looking back in cabin of *Robin*. Two seats at rear are for passengers

of the men will fly the same ship through a gigantic circle, a mile high and marked out by a number of Army observation planes. The keenest rivalry has been aroused, and the event will do much to promote flying,



The exterior of the Curtiss *Robin*, a cabin plane with 90 horsepower engine

# International Truck Triumphs Over Sahara's Wastes



"Baron Blixen drags his weary steps toward the drums. What an eternity it takes—"

**I**F I WERE asked to state why Baron Frederik von Blixen-Finecke and I crossed the Sahara by truck, I could only answer that in doing so we attempted and accomplished something which everyone claimed was impossible. We both felt that, having gone so far as buying an International Special Delivery for the trip, we would ignore advice and go on.

On March 26th we started our adventure from Kano, in Nigeria. Out of Zinder, appalling heat enveloped us, our thermometer registering 125° in the shade. Progress from Niamey on was slow, barely averaging ten miles per hour.

The desolation at Tabankort, an abandoned military post, would drive most white men crazy in a month. The heat is beyond description. The water is almost as salt as the sea, so we decided not to fill our two 10-gallon drums as we should pass another well called Asselagh, farther on. The going became steadily worse. At dusk we came to the conclusion we had missed the well. We were faced with the alternative of going on or of turning back.

Either way courted death and a terrible one, but we decided to go on. At 2:30 A.M., we were compelled to stop, overcome by exhaustion. A small glass of water and dry biscuits for us, but not a sound of complaint from our wonderful truck. The

## Thrilling story of first four-wheel truck to conquer 3,000 miles of world's greatest desert, by

**SIR CHARLES MARKHAM**

*British soldier, explorer and big-game hunter*

going became worse, involving corrugated iron sheets under the wheels, which otherwise would have sunk to the hubs in sand. Four feet forward—stop. Scratch sand, replace sheets, again forward four feet. There was less than a gallon and a half of water left. Our International was boiling constantly but kept faithfully on and every drop of water poured into the radiator was like parting with our life's blood. Finally, a speck on the horizon! Our hopes rise, "What is it," we cry, "can it be water?" Hardly can we curb our impatience. We reach the steel drum. Empty! Our hopes are dashed and both secretly think we have come to the end of our last journey.

The next day, we ran into a deep valley of sand. The truck sank in to the axle. Only a quart of water left—for the engine, or ourselves? We compromised with a mouthful apiece and the car drank the rest. Progress was terribly slow, the truck shuddering under the terrific strain from the resistance of the sand, but coming through with flying colors. We climb a small escarp-

ment, and see, barely a mile away, five drums standing in solitary state. Are they empty, or filled with water or petrol? Baron Blixen drags his weary steps toward the drums. What an eternity it takes to cover that mile; but eventually he reaches them.

It is water! With feverish haste we drink the precious liquid which means life.

Next morning we were off into the Tan-er-ruft Desert, where it has never been known to rain, and reached Reggan two days later. On April 12th we reached Algiers, having covered 4,535 kilometers (2,818 miles) in sixteen days. From Kano to Algiers, we consumed 156 gallons of petrol (187 U.S. gals.)

We were not only glad to have accomplished the journey, but to have done it in a regular stock model International Truck, without special equipment or preparation, other than extra fuel, tires, and water; no spare parts of any description were carried—or needed.

**NOTE:** These are short excerpts from this adventurous journey across Sahara. International Harvester will be pleased to send you with its compliments, the complete story of Sir Charles, in booklet form, profusely illustrated. Use coupon below.

International Harvester Company of America, Inc.  
610 South Michigan Ave., Chicago, Ill.

I would enjoy reading the full story of Sir Charles Markham's journey across Sahara.

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Above: Baron Blixen  
At Right:  
Sir Charles Markham



Seventies, using wings shaped like those of an albatross.

The most famous glider exponent is probably Otto Lilienthal, a German, who began experimentation as early as 1867. Lilienthal built monoplane gliders, with cambered wing surfaces, but otherwise of rudimentary construction. The rider's arms passed through padded tubes fastened to the under-surface of the wing; his body and legs swung freely underneath. Lilien-

thal's first man-carrying glider was built in 1891. Lilienthal was firmly convinced that to achieve human flight it was necessary to get practice in flying in some way. In this he was perfectly right. He made the mistake, however, of relying almost solely on the movements of the rider's body and legs for securing controllability. In spite of this, Lilienthal made some wonderful glides during the years 1891 to 1897 and contributed a great deal of knowledge to the art, before the accident in which he was killed.



The famous Darmstadt glider, which is being tested in this country

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To John J. Montgomery belongs the honor of making the first glide on United States soil. In 1884 he constructed gliders which used two cambered surfaces arranged in tandem, and which were equipped with horizontal rudders, and seats which could be swung from side to side to secure lateral control. Montgomery also employed a fixed vertical rudder, and also means for swinging the rear portions of the wing tips, thus anticipating modern aileron control. His very first glide, was 600 feet in length.

However, Montgomery did not find an opportunity of giving full scope to his

the cambered wing surface, are remarkable.

Montgomery seems to have been a very independent, as well as a very scientific worker. It was Octave Chanute who brought the Lilienthal tradition to America. Chanute, a civil engineer of established reputation, devoted all the last years of his life to gliding and aerodynamics, and after careful study of Lilienthal's work, went into camp on the sand hills of Dune Park on the southern shores of Lake Michigan. Here during the year 1896 he made over 1000 glides without an accident, performing many glides himself in spite of his advanced age of 64.

Chanute evolved a remarkable biplane glider, braced in the most approved form of a Pratt truss. Chanute still had the rider's body swung from the lower surface of his wings, but did not rely on skilled contortions alone for control. He employed a horizontal rudder, and swung the wings on either side in a fore-and-aft direction to secure lateral control.

It remained for the immortal Wright brothers to achieve the final solution of the problem of airplane control by combining a horizontal rudder and a movable vertical rudder with warping wings, thus



A typical "school" glider

for the first time, securing control about all three axes of the airplane. The wonderful success which Orville and Wilbur Wright achieved with their first powered craft was due not only to their general engineering ability and their wind-tunnel experiments, but also to their careful preparatory work with the Wright gliders at Kitty Hawk, North Carolina.

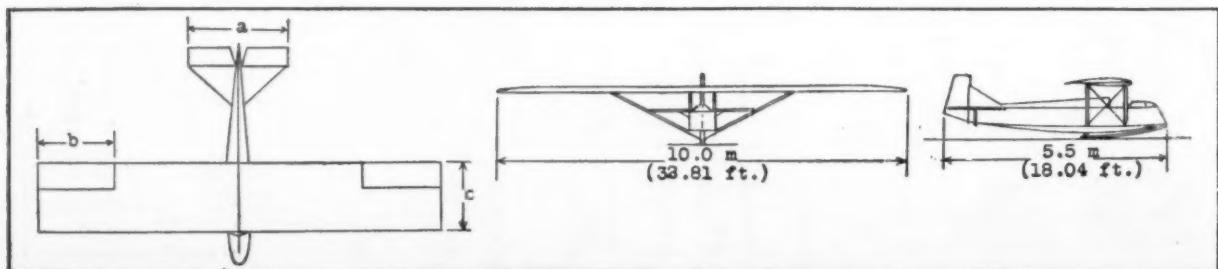
Even after their successful conquest of powered flight, the Wrights did not lose their interest in gliding and in 1911 they made a record soaring flight of nine minutes and 45 seconds, which remained the record until 1922 when the German Henzen stayed aloft for the remarkable time of 3 hours and 6 minutes.

The endurance record made by Henzen aroused great interest in the United States, and even created in the public mind an exaggerated importance of the possibilities of the art.

Although there is not the slightest possibility of gliding becoming a means of transportation, it offers real interest. It is a delightful sport, which, when properly conducted, offers very little danger. Gliders are simple and inexpensive to build and provide a ready outlet for young aviation enthusiasts who cannot find the means or parental permission for powered flying. It is a splendid preliminary training for airplane flight.

It appears extraordinary, therefore, that gliding as a sport has not yet taken root in the United States. A glider has been built and flown by the students of the California Institute of Technology. Another glider was built by the students of the Massachusetts Institute of Technology, and entered, although without participation, for a foreign meet in 1923. Nordman, an aeronautical engineer, made some glides on Long Island, after being towed by a

(Please turn to page 374)



Line drawings showing constructional details of a typical training glider



<b>PRICES</b>	
MERCHANTS EXPRESS —110" wheelbase	<b>\$ 665</b>
COMMERCIAL TRUCK —120" wheelbase	<b>775</b>
1 1/4-TON—130" wheelbase	<b>995</b>
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1 1/4-TON—150" wheelbase	<b>1345</b>
1 1/4-TON—165" wheelbase	<b>1415</b>
2-TON—150" wheelbase	<b>1545</b>
2-TON—165" wheelbase	<b>1615</b>
3-TON—135" wheelbase	<b>1745</b>
3-TON—165" wheelbase	<b>1775</b>
3-TON—185" wheelbase	<b>1845</b>

*Chassis f. o. b. Detroit*

COMPLETE trucks . . . a complete line of trucks . . . complete owner satisfaction . . . So runs public appraisal of Graham Brothers Trucks.

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transmission on 1 1/4, 1 3/4, 2 and 3-ton trucks.

All these features at extremely low cost—and without sacrifice of the rugged dependability and operating economy the world has learned to associate with everything Dodge Brothers builds.

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SOLD AND SERVICED BY  
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DEALERS EVERYWHERE

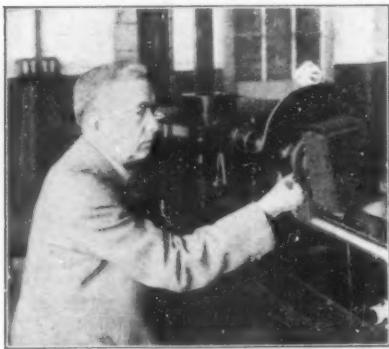
# Strays From the Ether

## *A Monthly Review of the Progress Made In All Branches of Radio Communication*

### Movies by Radio

RADIO'S most conspicuous leaders met at the plant of the Westinghouse Electric and Manufacturing Company recently to review the laboratory progress of what the layman might term imminent miracles of sight and sound transmission.

The most striking of all radio developments discussed was the broadcasting of motion pictures which, transmitted on radio waves, were picked up on a receiver



Dr. Frank Conrad and the television movie transmitter which he designed and is perfecting

located in the Westinghouse television laboratory and reproduced before those assembled there.

While radio movies are still in the laboratory stage, the event heralds the time when the radio listener will sit at home and have that most popular form of entertainment, motion pictures, projected by his own individual radio receiver.

The development of radio movies is a triumph of scientific engineering. Barely two months ago, the idea came to the mind of Dr. Frank Conrad, in charge of this branch of his company's activities, and the fact that he has brought the device to the laboratory stage in the degree of perfection witnessed, is said to have set a record.

Radio movies are a step beyond previous developments in television and required the invention of a number of appliances in addition to a great deal of scientific calculation, synchronization of various high-speed mechanisms, and accurate control of light and radio waves.

Photography in its simplest form consists of the reproducing of spots of light and shadow in the same arrangement as they appear in the subject photographed. The screening of a motion picture requires that a roll of film be operated at a speed which sends sixteen pictures a second before a projecting beam of light. Because of the structure of the human eye, if a series of pictures follow each other at the rate of 16 or more per second, the human eye sees it as a single moving picture.

All this the broadcasting of radio movies requires, with the addition that the spots of light must be transformed into frequencies, (some of which are in the audible

range), transferred to a radio wave and broadcast as electrical energy. In receiving the pictures, the process is reversed—the electrical energy is picked up, and the frequencies returned to lights and shadows, which when viewed present the radio movie.

In the first step of the process a pencil of light traverses each picture, or "frame," as it is called, at the rate of 60 times in a sixteenth of a second. This process produces a 60-line picture, as clear as the usual newspaper halftone illustration.

The pencil of light is produced by a scanner, which is a disk with a series of minute square holes near its rim. The disk is so arranged that all light is excluded from the film except that which goes through the square holes. The disk turns very fast, and as it turns it passes the square beam of light across each "frame," with the result that an individual beam of light touches every part of the "frame."

The beam of light, passing through the film, falls upon an electric eye or photoelectric cell, which is not unlike an oversized incandescent lamp. Within the cell, however, is a metal whose electrical resistance varies with the light falling on it. Caesium, a rare metal, is used in the Westinghouse cell. The amount of light falling on this cell determines the amount of current passing through it. The result is that each individual beam of light sends an electrical impulse which varies directly according to the amount of light or shade in the film through which it passed.

The beams of light have now become electrical impulses and are sent on to the broadcasting station. Here the beams assume definite and varied frequencies, some of which are audible. Dr. Conrad states that these frequencies range from somewhere near 500 to approximately

60,000. Since the human ear is limited to frequencies of approximately 15,000, much of the radio movie wave is inaudible.

At the broadcasting station these frequencies are used to modulate a radio wave and are transmitted exactly as the ordinary music or voice. The radio signals now can be sent across a room, or across the continent. Their distance range is limited only by the broadcasting station's equipment.

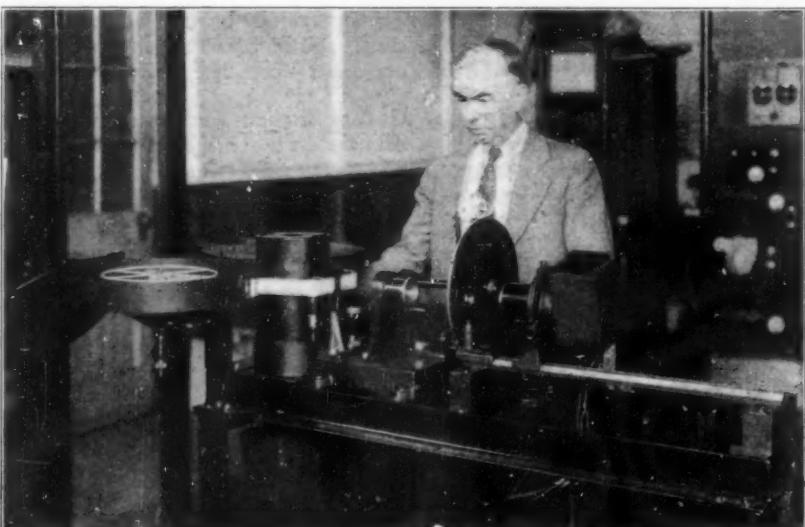
In the Westinghouse demonstration, the signals traversed a distance of about four miles; two miles from the laboratory to the broadcasting station by wire and two miles back to the laboratory by radio.

To turn these radio waves back into light, an arrangement which permits the use of a mercury arc lamp is used. By this adaptation the weak radio currents control the action of the many times more powerful current operating the arc lamp. This action may be compared to the action of a radio tube, where the weak radio current on the grid of the tube controls the action of the independent and more powerful plate current.

Thus the mercury arc lamp goes bright or dim as fast as the current changes and its light at any instant is in proportion to the light that the electric eye sees in the same instant. To return the dots of light to their original pattern, another revolving disk or scanner is used, which is similar to the transmitting scanner.

Both these scanning disks turn at exactly the same speed; the hole in the receiving disk must be exactly in the same relative position as the corresponding hole in the transmitting disk. In other words, they must be synchronized.

Westinghouse engineers were the first to develop a feasible method of synchronization and their method was by means of



Dr. Conrad is shown here adjusting the instruments of the television transmitter for motion pictures. Notice the strip of film placed in the mechanism

Amelia M. Earhart

Amelia M. Earhart, first woman to fly the Atlantic by aeroplane  
says—

"Lucky Strikes were the cigarettes carried on the 'Friendship' when she crossed the Atlantic. They were smoked continuously from Trepassey to Wales. I think nothing else helped so much to lessen the strain for all of us."

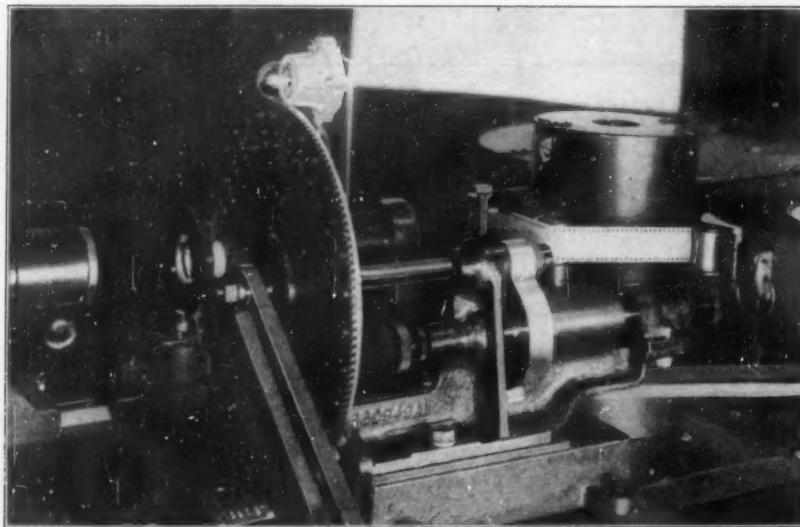
**"It's toasted"**

No Throat Irritation - No Cough.

© 1928 The American Tobacco Co., Manufacturer

radio. From the transmitting equipment, which may be located in the broadcasting station, they transmit a constant frequency wave of 5000 cycles. This wave is produced by a tuning fork and transmitted over a special carrier wave from the broad-

and motor noise absolutely disappeared. Furthermore, the strength of reception was increased 50 percent, and there was a marked increase in selectivity. The motor noise was coming to the set in the original installation through the common ground



A close-up of the radio movie projector. Note the spot of light that reaches the film through a small hole in the scanning disk. This system of sending motion pictures by radio is one of the latest developments of television, but follows to a great extent in the footsteps of past accomplishments in the art

casting station. The constant frequency note is received and by means of special apparatus controls the speed of synchronous motors, which drive the scanning disks of both transmitting and receiving radio movie equipment.

#### Sweden Heads Europe With 53.6 Radio Sets to Every 1000 People

ACCORDING to late statistics, Sweden is leading all European countries in radio. There are in Sweden 53.6 radio sets to every 1000 inhabitants, in England 53, in Norway 22.1, in Switzerland 15.9, in Czechoslovakia 15.2, in Denmark 44.8, in Austria 43, in Germany 32, in Hungary 9, in Finland 6, and in Belgium 4.1.

#### Counterpoise

WHEN experimenting with a radio receiving set in a location where man-made static was excessive, David Grimes, a well-known radio engineer, recently found that a counterpoise proved to be almost a perfect solution of the problem. Thinking that many of our readers may have similar trouble, we quote Mr. Grimes from the New York Sun as follows:

"A counterpoise installation was decided upon as being the best of a bad bargain. There was simply nothing else that we could do. A Number 14 copper rubber-insulated ground wire was run out of the window and strung horizontally around two sides of the building. It was attached and hung from several window sills on the same floor. We hooked up the set to the antenna, which was located on the roof, and to our new counterpoise as a ground, instead of using the common ground connection in the building. The counterpoise was not connected in any way with the ground. In fact, the set was not 'grounded' at all in the ordinary sense.

"The results were nothing short of a miracle! All trace of the man-made static

connection and not by direct radiation and pick-up through the antenna. By removing the set from this ground this source of interference was eliminated. As soon as the counterpoise was employed the signals increased and the tuning became sharper because the antenna and counterpoise were much lower in resistance than the antenna and the long common ground connection previously used."

#### Radio for the Blind

BLIND radio fans obtain the latest news of circuits and the like through the *Courrier-Braille*, a publication for the blind, which is distributed in France and

Belgium. This magazine has been printing diagrams in the Braille system which enable those deprived of sight to construct their own radio receivers without assistance.

Instead of the usual printed symbols, this magazine publishes embossed diagrams of receiving circuits, using raised lines of dots to indicate wires, and a raised "picture" to show what instrument is to be used.

#### Short Wave Adapter

THERE is now on the market an excellent type of short wave adapter for use with broadcast receivers. It was designed by E. T. Flewelling and is being manufactured by the A. C. Dayton Company of Dayton, Ohio.

The adapter is designed to be plugged into the detector socket of a standard broadcast receiver, whereupon the audio amplifier and the loudspeaker of the regular receiver will be employed for reproducing the short-wave signals. Thus it will be seen that an adapter of this type can be used with any broadcast receiver which employs an audio-frequency amplifier.

#### Oscillation Control

ALTHOUGH there are many methods of controlling oscillation in radio-frequency amplifying circuits, most of them have serious drawbacks. One of the best and simplest is that wherein a resistance is placed in a series with grid lead of the radio-frequency tube. A standard clarostat is satisfactory for this purpose as its range is variable and the best setting for the particular instruments employed can be readily obtained. One of the advantageous features of this method of oscillation control is that amplification decreases slightly at the higher frequencies. Since feed-back increases with frequency, the decreased amplification will prevent excessive feed-back with its consequent unbalancing of the circuit.

The above outlined method has one disadvantage in that it broadens the tuning somewhat. To avoid this, the same type

(Please turn to page 368)



B. H. Winstor—Gillarin and Ewing  
Miss Elizabeth M. Zandonini of the Radio Laboratory of the Bureau of Standards, who has gone to France and Italy to study amateur radio station conditions there. She is an active member of the American Radio Relay League

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## Amazing—Invigorating

AFTER your next shave, douse Listerine on the face full strength. What a nice reaction. Cooling! A new sense of vigor and freshness. Amazing stimulation for tired skin. And all the usual smarting and burning gone at once.

Also you have the satisfaction of knowing that the antiseptic essential oils of Listerine are enemies of infection. One trial of Listerine this way will win you. Why not today? Lambert Pharmacal Co., St. Louis, Mo., U. S. A.

Have you TRIED the new  
LISTERINE SHAVING CREAM?  
Cools your skin while you shave  
and keeps it cool afterwards.  
An outstanding shaving  
cream in every respect.

# LISTERINE

THE SAFE ANTISEPTIC

# Industries From Atoms

*A Department Devoted to the Advancements Made in Industrial and Experimental Chemistry*

### Asphalt Emulsion for Curing Concrete

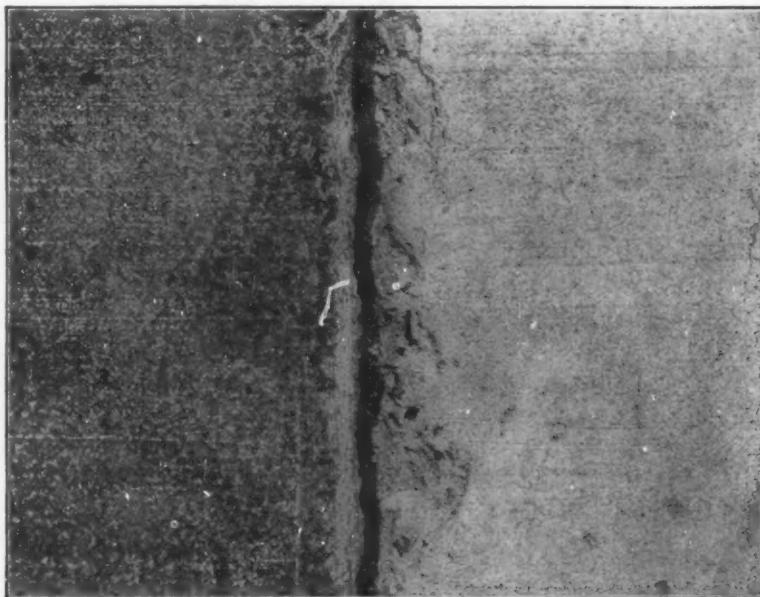
WHILE to the casual observer it would appear that the constantly growing trend toward concrete as a material for highway construction will gradually supplant asphalt, it begins to appear that concrete roads will eventually offer

most previous attempts to plate on aluminum for trade purposes have proved unsuccessful due to its peculiar position in relation to other metals in the electro-motive series and the problems which this position presents. Consequently, urged by the necessity for developing a more favor-

able means of electro-plating on aluminum and its alloys, the Aluminum Company of America established a research fellowship at Mellon Institute in 1925. After a study of nearly three years, the results of the fellowship's incumbent, Harold K. Work, were presented recently at the 53rd general meeting of the American Electro-Chemical Society held in Bridgeport, Connecticut.

After the surface has been cleaned and rendered active, Mr. Work submits the aluminum to a roughening process. This is accomplished preferably by chemical etching which consists of placing the metal in an acid dip, the composition of the dip being determined by the alloy to be plated. When the alloy is such as will take a high metal dip, the surface of the aluminum is not only pitted by the action of the dip, but an immersion layer surface is formed which greatly facilitates plating. Pits thus formed in the surface of the aluminum serve to secure the plating.

The roughened metal is then immersed for the first coat in a nickel plating bath to which an electric current is applied. A nickel finish over aluminum is particularly desirable since the similarity in the color of the two metals renders worn spots in the plating less perceptible and the white corrosion products are more easily removed than those of other metals.



This close-up view of a section of concrete shows at the right the cracks in a hay-cured portion, and the breaking down of the edge at a longitudinal joint. At the left is a section cured by the Curcrete method, free from cracks

an excellent market for the producers of asphalt. This development is the result of research work on the properties and uses of asphalt emulsions.

The Barber Asphalt Company, for example, one of the largest producers of asphalt in America, has recently developed a material known as Curcrete. This is an asphalt emulsion used in curing concrete highways, foundations, sidewalks, floors, platforms and other flat slab surface construction. The emulsion is applied to newly finished concrete by a sprayer and produces a continuous glossy film which materially retards the evaporation of water.

The Curcrete method is claimed to result in a more uniformly cured slab of increased strength. It prevents surface cracking, checking and scaling and gives increased resistance to surface abrasion. It eliminates the usual puddling or hay-curing. Curcrete leaves a pleasing darkened surface which effectively prevents the glare common to the concrete highway.

### Electro-Plating on Aluminum

DESPITE its valuable characteristics of lightness and ease of manufacture, aluminum has not attained commercial importance in the field of plated metals.

### Titanium Takes Its Place as Paint Pigment

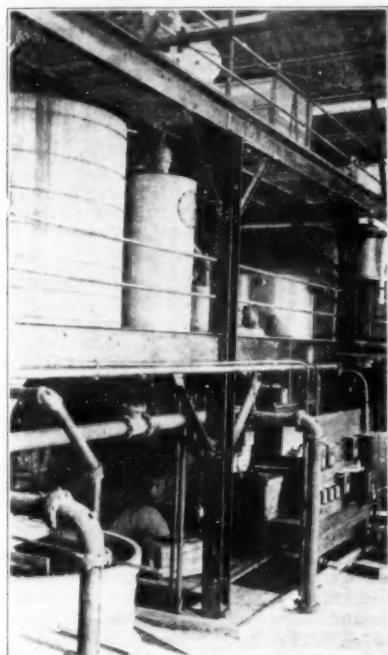
RECENTLY a new pigment for white paint, possessing rather remarkable qualities, has become available by the erection of a plant in Baltimore by the Commercial Pigments Corporation. Instead of



Curcrete in the form of a fine spray, is applied to freshly finished concrete. Notice that the spraying is being done within 100 feet of the concrete mixer

lead, the less common metal titanium is the basis of the new paint material. Titanium dioxide is not a novelty, having been prepared in the laboratory long ago. This company, however, is the pioneer in its commercial production and it is extremely interesting to note that the process employed duplicates that used in the laboratory almost exactly except that huge vats are used instead of beakers and test tubes.

Bruce K. Brown, writing in *Chemical and Metallurgical Engineering*, describes the newly developed process. The titanium dioxide is extracted from ilmenite, a



Where "whitest white" paint is made from titanium oxide

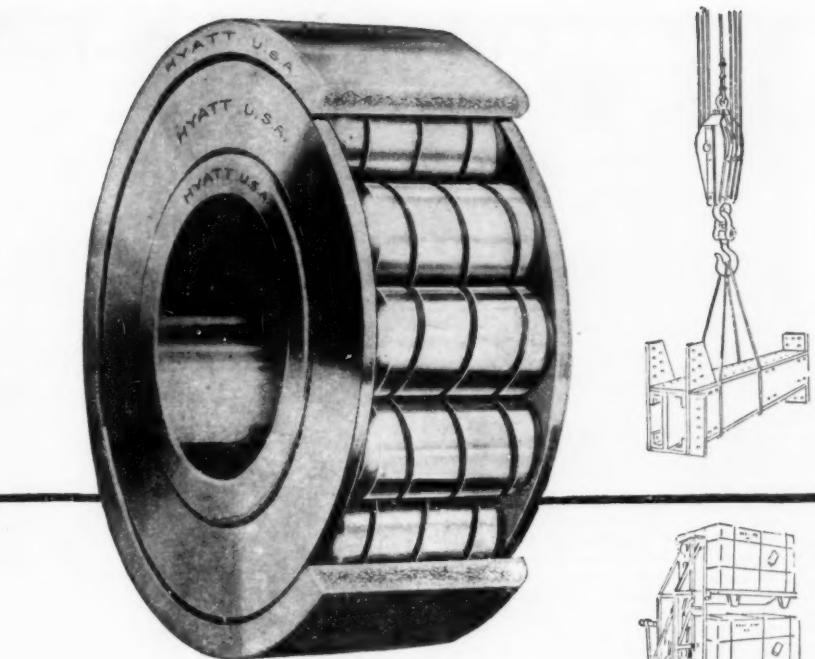
titanium-iron ore. The new plant produces 10 tons of pigment daily and 40 tons of ferrous sulphate (copperas) as a by-product.

The titanium dioxide pigment obtained by this series of operations is characterized by having a higher hiding power than any other known white pigment. It is a very pure product, containing less than .005 percent total of iron. Special processes developed by the corporation permit the production of a pigment having an oil absorption of about 25, which is considerably less than that of titanium dioxide pigments previously available on the market. The diversified uses and exceptional qualities of titanium dioxide pigments are so well known that they need not be discussed here.

This plant also produces titanium dioxide in the form of an unfilterable colloidal dispersion containing as much as 400 grams per liter of titanium dioxide. Experiments have shown the value of this material in the production of refractories and mineral glues, and research has demonstrated the possibility of using it to replace tin in the weighting of silk and in other analogous fields.

#### Washing Machines in Industry

ONE large manufacturing concern in the east has taken a page from the housewife's book and is effecting a yearly saving



## Where Strength and Economy Unite!...

THE rare combination of mechanical ruggedness with reduced operating costs has given Hyatt Roller Bearings a priceless reputation among builders of industrial, agricultural, mining and transportation equipment.

Sturdy, smooth rolling Hyatts produce unheard of power savings while avoiding production interruptions—while minimizing maintenance—while banishing the need for bearing replacements.

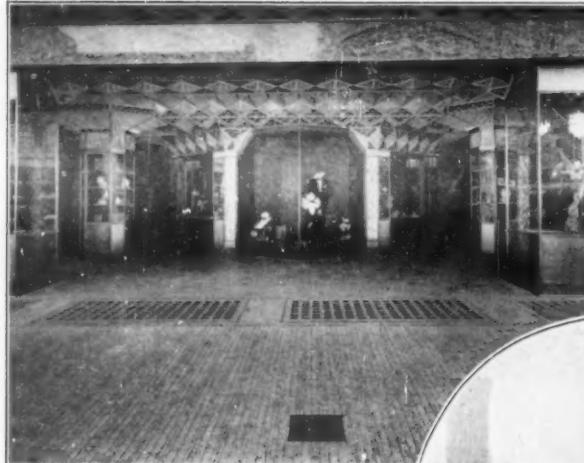
Years of unwavering bearing satisfaction is Hyatt's contribution on any assignment. In some applications Hyatts have recorded 37 years of flawless performance. Their overwhelming preference has been a matter of course—of recognition.

No other bearing can give service so smooth, so lasting, so economical. Small wonder that all industry is turning to Hyatt for permanent bearing performance.

**HYATT ROLLER BEARING COMPANY**  
Newark Chicago Detroit Pittsburgh Oakland

**HYATT**  
**ROLLER BEARINGS**  
PRODUCT OF GENERAL MOTORS





Chemists have successfully developed a rubber paving material which gives promise of wide application in the future. The above view of a Los Angeles store front shows the first colored marbelized rubber sidewalk laid in the world. The rubber chemists matched the marble used in the exterior of the building, providing a paving which is not only attractive but is said to be serviceable

of over 6000 dollars by the use of ordinary household washing machines in washing soiled wiping cloths, towels, et cetera, that are used in its own factory. Four machines with one attendant, make this saving possible.

Prior to the installation of their present washing system, the factory discarded all wiping cloths as soon as they were soiled, using an average of eight bales of cloth a month, having an average weight of about 700 pounds each. At a cost of about 14 cents per pound, this represented a yearly expenditure of about 9700 dollars. Now this rag consumption has dropped to an average of two and one half bales per month, or a yearly cost of about 3000 dollars. Special check-ups have proved that many of these ordinarily cheap "wipers" have been re-washed and re-used 16 times. Better grade rags have been washed as many as 40 times and look good for 40 more washings.

Washroom towels, hospital uniforms, et cetera, previously were sent to a commercial laundry at an average yearly cost of 900 dollars. These pieces are also laundered in the factory now. Total savings (900 dollars on laundry work plus 6700 dollars on rags) is 7600 dollars yearly. Total washing cost including depreciation on washing machines, salary of workman, gas and floor space, 1155 dollars. Net saving, 6445 dollars.

#### Rubber Would Lengthen Usefulness of Chewing Gum

THERE is no salvaged rubber from discarded heels or worn-out inner tubes in the chewing gum one gets from slot machines; nevertheless the millions of Americans who daily exercise their jaws are putting a certain amount of rubber into the gum through the process of mastication.

"Five percent of chewing gum," Dr. W. L. Semon, an authority on rubber told the Institute of Chemistry recently, "is rubber. A wad, after chewing, weighs only



about one fourth of what it did before. For in the mastication, sugar, dextrine, and other ingredients are dissolved.

"If you ever get a slice that just crumbles in your mouth, blame science and oxygen," said Dr. Semon. "Chemistry has not yet found a good anti-oxidant which is non-toxic. When it does, the life of a piece of gum may be extended for many more years."

#### High Pressure Gas Storage Extends Service Radius

WHEN motoring through the "open spaces," we are accustomed to observing the lines of steel towers bearing high voltage wires which make possible the economical transmission of power over great distances. Behind this distribution system lies years of development work, in

Above: Signs on pavements required repainting so often that experiments with colored rubber tiles were conducted. The "stop" sign shown has been in service for four years and is still in perfect condition. Left: Everyone who walks across the Michigan Avenue Boulevard Bridge in Chicago has all the advantage of rubber heels, even if he hasn't got them. A special rubber pavement is the answer

which chemists as well as electrical engineers contributed their bit to the complex problems involved in thus harnessing the giant. Less familiar, as yet, are the visible evidences of the same trend in the distribution of manufactured gas, yet the technical men of the gas companies are also developing high pressure distribution systems in order that homes and factories remote from the gas plant may be assured of an unfailing supply of gas for industrial fuel and home cooking, heating, refrigeration, et cetera.

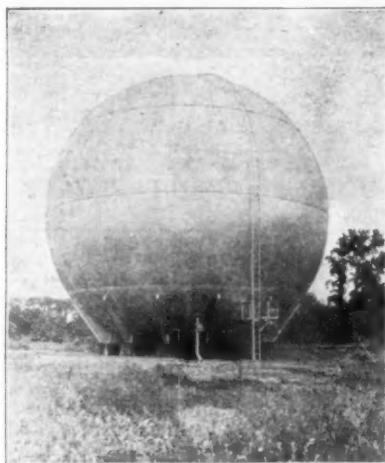
Shown in the accompanying illustration is a type of tank for the storage of gas under high pressure which is beginning to dot the countryside and which may soon be a familiar sight along the nation's highways. This spherical gas holder is known as the Hortonsphere, named after Mr. Horton, one of the owners of the Chicago Bridge and Iron Works. It is a truly spherical steel shell, built up of riveted sections. In cylindrical tanks it has been found that



Washing machines salvage wiping cloths in large factory

welded tanks are superior to riveted tanks but as yet construction difficulties make a welded sphere a doubtful proposition due to the thickness of the plates. A sphere, 10 feet in diameter of five sixteenths inch plate, with all seams welded, has been erected for tests being carried out at the University of Illinois. These tests will extend over a long period, but the tank will eventually be tested to destruction.

The maintenance of Hortonspheres or any type of high pressure storage is less than that of the familiar low pressure holders. The heavy sheets of high pressure storage are less affected by rusting than the lighter sheets of low pressures. There are



"Hortonsphere" gas tank for high-pressure distribution in Indiana

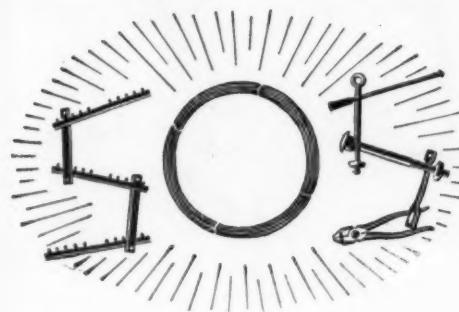
fewer contacts between framework and structure and fewer joints, which means fewer weak points. For the same volume of storage less paint is required for the high pressure holders. The painting can be done under better conditions and the resulting surface is less affected by conditions of operation. In the winter time there is no cleaning of snow from the crown sheets and no water to be kept heated.

#### Firing Furnaces to Reduce Smoke Increases Efficiency

**W**HERE there's smoke, there's fire," but that fire is not burning its fuel efficiently. The chimneys of large buildings or apartment houses are often serious offenders in emitting objectionable smoke, or at least they are more noticeable because of their prominence and because they are usually in locations where there are no factories. The large heating boilers attached to such chimneys are often operated by firemen who are not too well trained and who find it difficult to fire the customary simple type of furnace.

That a reduction of the smoke emission can be obtained without additional fuel cost, and with a lowering of it because of better efficiency, has been illustrated by recent tests conducted by United States Bureau of Mines Engineers with a large heating boiler. In the first series of tests the furnace construction was of the simple grate type suitable for burning coke or smokeless coal. When using bituminous coal and giving the boiler such attention as might be expected in service, it was not possible to prevent the emission of ob-

(Please turn to page 377)



## —a signal with a double meaning

S.O.S.—flashed from out of some sea disaster sends its tragic appeal to "Save Our Souls."

S.O.S.—in France with Pershing these letters meant a prompt and thorough Service of Supply backing up the front lines.

Here in America today the business of telephone manufacture and distribution too has its S.O.S.—the prompt service of supply with which Western Electric backs up the nation's telephone companies.

The emergencies, when fires, floods and storms threaten to cripple telephone service, are a part of the day's work, and are anticipated and provided for by previous planning in building up reserves of equipment in a nation-wide chain of 33 distributing houses.

And then there is the greater; though less spectacular, every-day job of providing the sinews of telephone service for the nation—a service of supply challenging comparison in efficiency and cost.

Thus as distributors, and also as manufacturers and purchasers for the Bell System, Western Electric finds its adventures in many fields.

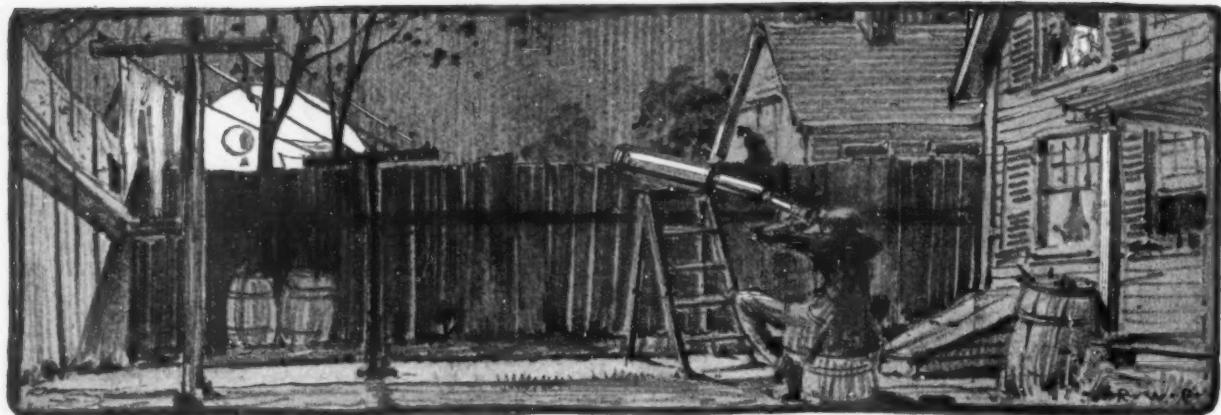
All to serve you when you raise your receiver off the hook!



# Western Electric

Purchasers... Manufacturers... Distributors

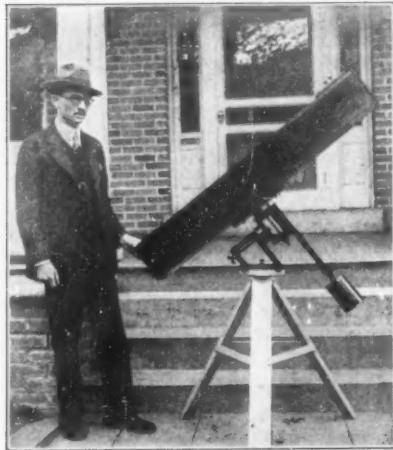




## The Back Yard Astronomer

*A Department Devoted to Interests of the Amateur Telescope Maker*

WHAT kind of a telescope can a man make who lives in a city house where workshop facilities are cramped and limited? Hugh G. Boutell, 3723 Jocelyn St., Washington, D. C., has made a telescope without a single piece of lathe work. We will let Mr. Boutell describe it.



Mr. Boutell and his wooden telescope

"The readers of the 'Back Yard' may be interested in the accompanying photograph and description of my reflecting telescope, made according to the directions in the excellent SCIENTIFIC AMERICAN handbook, 'Amateur Telescope Making.'

"I obtained my glass disks and abrasives from John M. Pierce of Springfield, Vermont, and in this way got just what I needed in the shortest time and with no bother at all. Making the mirror occupied my evenings for about three weeks. As a post on which to mount the tool I used a heavy chest with the handles removed. The chest was placed on end on the cellar floor and loaded with a big chunk of concrete. This formed a very rigid support of smaller dimensions than the barrel usually recommended for this purpose. Also, it brought the tool to just the right height from the floor for convenient working, which seems to me to be an important point.

"Every stage of mirror making is interesting, but the testing by Foucault's method is particularly fascinating, and gives one a new insight into the accuracy of physical measurements, without the use of any of the complicated costly laboratory instruments.

"The mounting was made almost entirely of wood, which is comparatively cheap and can be worked with only a small number of hand tools. The tube was made of one-half inch white pine, six and one half inches square inside. The bottom of the tube was made of two pieces with the grain crossed. This forms the cell for the mirror. The diagonal is a one-inch prism carried in a tin support, and this with the adapter tube is removable as a unit, since both are carried by a block of hard wood which is attached to the telescope tube by bolts and wing nuts. The holes in the block are somewhat large, so that a certain amount of adjustment can be made in lining up the mirror, prism, and eyepiece.

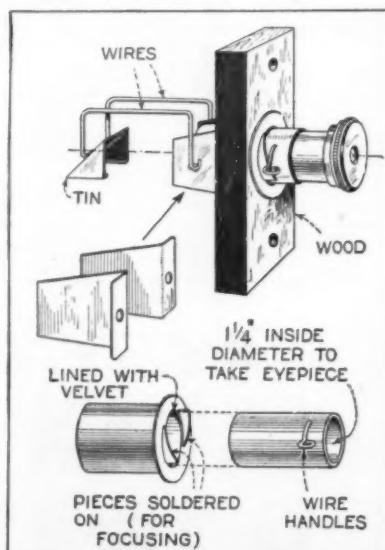
"The telescope is carried by an equatorial mounting made by assembling small

pieces of one- by four-inch maple. The mounting is very solid, being put together with countersunk screws and glue. The axes are one-half inch lag bolts with washers and wing nuts. The use of this type of built-up mounting avoids the necessity of buying any large blocks of hard wood which are more difficult to work. The axes are well greased and the motion is smooth.

"The setting circles are made from four



Optical glass is made at only two places in the United States, one of which is the Bureau of Standards. Before the World War, America made none at all. The watch is seen through nine inches of this American-made product



Eyepiece and prism assembly—Boutell

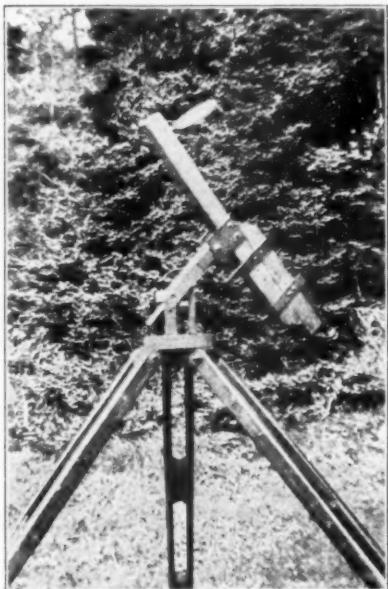
five-inch metal protractors such as are used in drafting work. The cross-bars were cut out and the graduated arcs soldered to circular pieces of tin. These circles answer very well for rough work.

"The mirror was silvered by Brashear's process, and strangely enough this proved to be one of the most difficult parts of the entire job. However, the technique was finally mastered and a good heavy coat of

silver obtained on the face of the mirror.

"The total cost of the telescope was not far over 25 dollars, and the performance, for a first attempt, exceeds my expectations. The light grasp is astonishing to one accustomed to very small refractors, and the complete absence of chromatic aberration is a great advantage. The picture which even this little instrument gives of the magnificent Orion nebula with the beautiful little stars of *Theta Orionis* nestled in the midst of the silvery haze will not be soon forgotten by anyone unacquainted with the wonders of the heavens."

Mr. Boutell comments on the height of the post used during grinding and polishing. Many amateurs use too low a post, and thus they acquire an advanced case of the "wash-tub bends." For comfort the



Mr. Clish's simple refractor

top of the mirror should come about on a level with one's floating ribs. It is also possible to sit down at the work.

A. R. Clish, 71 Winter St., Portland, Maine, sends in a photograph of a simple refractor he recently assembled. Although he makes no mention of a crown and flint lens for the objective or of the rather exacting calculations involved in designing such a lens, he states that his telescope functions well enough to gratify him. This is what he writes:

"For the past two years you have published each month the description of a home-made telescope. Most of these descriptions have mentioned the long time necessary to grind and polish the mirror. I am a student at a normal school, having neither time nor facilities to make such instruments. I set out to design a telescope simple enough for my troop of Boy Scouts to use when they wished.

"I asked a local optician to make a lens for me. I suggested that he do it in his spare time, and that it would be an experiment on his part to see if he had the ability to do it. He made me a very good lens three inches in diameter, having a focal length of 24 inches. The lenses for the ocular had me stumped for a time but I happened to think of the lenses in the finder of a camera. I got three of them

(Please turn to page 370)



#### Motorists

You need a Basline Autowline in your car for emergencies. Made of  $\frac{1}{4}$ -inch Yellow Strand wire rope with patented snap hooks for quick attaching. Very strong but small enough to coil flat under a cushion. Ask your accessory dealer.

## Art— and Wire Rope

From the moment a "cut" of stone leaves its quarry bed until it graces some beautiful building, wire rope is its "motivating force."

And when the quarryman, stone cutter or builder is mindful of his own best interests, Yellow Strand Wire Rope will usually be found "on the job".

Yellow Strand is the highest of high grade wire ropes. Its wire is of Swedish stock and drawn abroad to the most exacting specifications. This super-wire is "laid up" into rope by one of the oldest wire rope manufacturers in this country. Yellow Strand's economy is as distinctive as its "strand of yellow".

This company also makes all standard grades of wire rope for all purposes.

#### BRODERICK & BASCOM ROPE CO.

843 North First Street, St. Louis, Mo.

Eastern Office and Warehouse: 68 Washington St., New York City

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# Yellow Strand WIRE ROPE

MR462

# Firestone

**The Tire Supreme  
for TRUCKS  
and BUSES**



**FOR EXTRA STRENGTH, STAMINA and MILEAGE**

The greatest problem of heavy duty tire service is heat and friction generated in the thick carcass. Firestone has solved this with the patented Gum-Dipping process—dipping the cords in a rubber solution which saturates and insulates every fiber of every cord with rubber. This is the only known method which carries the rubber to the innermost recesses of the cords, insulating each component part and unifying the whole structure of the tire. The Firestone Service Dealer is a trained tire man, who knows tires and tire sizes and the operating conditions in your locality. With his complete stock of Firestone Truck and Bus Tires and his up-to-date service shop, he will save you money and serve you better.

MOST MILES PER DOLLAR



AMERICANS SHOULD PRODUCE THEIR OWN RUBBER *Harvey Firestone*



*The Musical Sensation*  
**ACCORDEON**  
*Played by Music Rolls*

Without any Knowledge of Music or Notes you play in a few minutes, perfect like an Artist, latest hits, songs and dances. No study or practice. Nobody can see the arrangement. Three models. \$40.00 \$55.00 \$70.00. Every instrument guaranteed. Interesting circular No. 4 and Roll List mailed free. TREASURE SALES COMPANY, 1690 Boston Road, New York

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EVER-USE ELECTRIC MOTOR ATTACHMENT



ONLY \$3.95

Fastens directly on motor shaft, no pulleys or belts required. Hides wiring.

stones, buffers, saws, wire scratch brushes, drills, etc., can be used.

Electric power required. Voltage depends on motor.

Special Corpors on New Electric Motors. Write for your requirements.

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(Established 1840)

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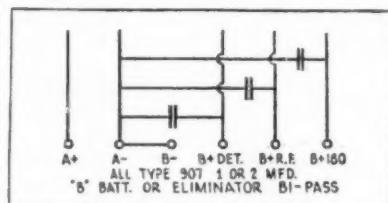
**Strays From the Ether**

(Continued from page 360)

of variable resistance may be inserted in the plus "B" lead. In this way, the effective plate voltage may be carefully regulated to the best value for the particular tubes employed. This resistance may also be used for a volume control when listening to local stations, and it does not have the disadvantage of broadening the tuning. The resistance should be shunted with a one half microfarad fixed condenser.

**Why By-Pass Condensers?**

SEVERAL years ago the Dubilier engineering staff recommended by-pass condensers across the plate supply of audio-frequency and radio-frequency circuits,



How by-pass condensers are connected to the power supply source

after an exhaustive study of the action of by-pass condensers. The idea was not received with much enthusiasm at the time, being looked upon as the making of a mountain out of a mole hill. Today, however, when volume and tone quality are considered of paramount importance to meet the requirements of the critical radio ear, by-pass condensers are widely employed in most manufactured and home-built receivers, whether socket-power or battery operated.

In the case of the "B"-eliminator, the use of by-pass condensers for the various plate circuits improves the overall filter action of the "B"-power unit and decreases the hum or ripple to the vanishing point.

When "B" batteries are employed as the source of power, the by-pass condensers act as low impedance paths and prevent audio-frequency regeneration which makes its presence known by howling or again by the so-called "motorboating." In any event, the use of by-pass condensers invariably leads to improved volume and tone quality.

Because of the fairly low voltage handled, with the exception of the by-pass condenser shunted across plus "B" maximum and minus "B," low voltage condensers may be safely employed, of one or two microfarads capacity.

**Radio Unsuccessful for Police**

SOME time ago, the New York City Police Department purchased over 100 radio direction finding sets at a cost of about 15,000 dollars. Exhaustive experimental work has shown that under the plans originally laid down, the sets are unsatisfactory for the required work.

**Ten Commandments for Good Tone**

1. Tune in on signals of sufficient strength, from a good broadcasting station. That is the foundation of good tone quality.
2. Employ the best possible amplifier,

capable of the necessary amplification without distortion.

3. Use tubes of sufficient capacity to handle the "wallop," particularly for the last or power tube.

4. Have ample "B" or plate voltage and current available for the various tubes, so they may work at their full capacity at all times.

5. Employ the necessary "C" battery or grid biasing for all tubes requiring same. A variable resistor will provide the precise balance between plate voltage and grid biasing needs.

6. By all means procure the best type of loudspeaker for your set. It is sometimes wise to try out several types until the one that matches your amplifier best and pleases your ear most, is found.

7. There should be some form of volume control, for a set without a volume control is like an automobile without a steering wheel. Use a clarostat across antenna and ground binding posts.

8. And in addition to volume there should be a tone control, in the form of a variable resistor across the secondary of the first audio transformer, or, better still, a variable resistor and one fourth microfarad condenser in series across the amplifier output.

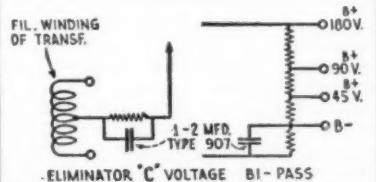
9. Experiment with various locations for the loudspeaker until the best results are obtained.

10. Always adjust the cone-type speaker driving pin, with the speaker silent, to compensate for weather and temperature changes before starting a program.

#### By-Passing the Grid Bias Resistance

**I**N most instances where a resistance is employed for the purpose of obtaining "C" bias or "C" voltage, no by-passing condenser is employed. This is an important oversight, since audio-frequency currents must pass through this part of the tube circuit, with the resistance offering serious opposition to their flow because of straight resistance and, in the case of wire-wound resistors, the inductance or choke-coil effect as well. In fact, there is an appreciable loss of volume and tone quality in the absence of a by-pass condenser.

The engineering staff of the Dubilier Condenser Corporation has made a study of by-pass condensers for grid-bias resistances, which forms the basis for the present suggestion. In the accompanying diagram will be noted two typical grid



"C" voltage resistances should always be by-passed, as shown

biasing schemes, with by-pass condensers properly applied. Because of the low voltage-drop in such resistance circuits—generally not more than 80 volts—a low-voltage condenser of one or two microfarads may be employed with satisfactory results. There will be a marked improvement in volume and tone when a by-pass condenser is shunted across any grid bias resistance.

and Now

## Controlled Heat for Less Money !

Controlled heat? Exactly that! A healthful, even temperature when you want it—where you want it—as long as you want it! For the cottage or the mansion. You want your home heated to 70 degrees? Then 70 it is. Not 68 or 72, but 70! Without so much as a glance at the thermometer on your part!

And here's the surprising thing. Burn ANY fuel (except oil or gas) and do it far more economically the Germeyer way.

Will quickly pay for itself in fuel savings alone!

No wasted fuel; more heat. Less care; no trouble. Just a steady, even healthful temperature all the time. A dissatisfied user is unknown!

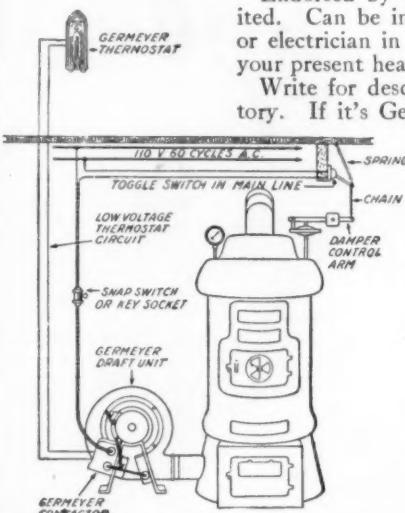
Endorsed by Heating Engineers wherever exhibited. Can be installed by any competent plumber or electrician in an hour or so. No alterations to your present heating plant. No servicing required.

Write for descriptive literature direct to the factory. If it's Germeyer it's guaranteed. There's a Germeyer Man near you; write for his name and address.

#### Note To Dealers

Splendid territory still open to competent and responsible firms and individuals seeking to tie up with the coming residential heating methods as pioneered for years by Germeyer. Exclusive territory; attractive profits. Write for details and plan, listing your own qualifications and business responsibility.

**Germeyer Engineering Co., Inc.**  
**601 Walnut St., Harrisburg, Pa.**



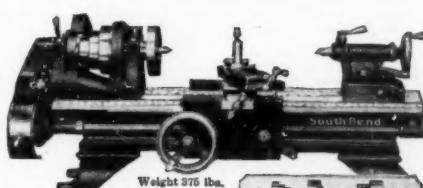
#### Why PURE CHEMICALS CORRECT ALL FEED WATER TROUBLE:

They prevent precipitation, control concentration, stop and prevent corrosion and pitting, remove oil or grease (carbonized or not), act uniformly under varying temperatures and pressures; everything that is required to successfully treat boiler feed water. Only Pure Corrective Chemicals do this. Pamphlet on Request

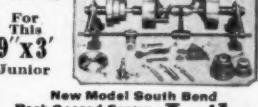
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S. S. Agents for Straits Settlements, Jersey City, N. J., U.S.A.

#### Magnified 225 Diameters This is what the tip of a fly's leg is like when seen through the ULTRALENS MICROSCOPE



Only \$12.40  
Monthly Payment



Has power feed to carriage, graduated compound rest, set over for taper turning,  $\frac{1}{4}$ -inch hole thru spindle and phosphor bronze spindle bearings. Also made with  $2\frac{1}{2}$ ,  $3\frac{1}{4}$ ,  $4$  and  $4\frac{1}{2}$  foot bed.

Price \$155.00. Down Payment \$31.00,  
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$\frac{1}{4}$  H. P. Electric Motor operated from ordinary lamp socket. Costs less than 2¢ an hour to operate.

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Cut threads

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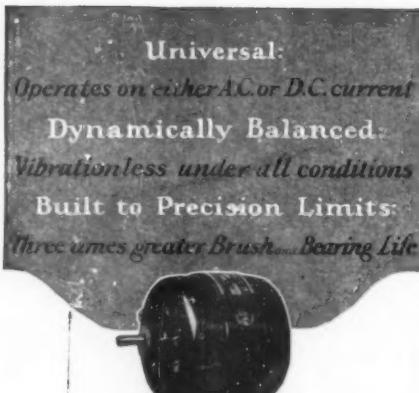
rods

Finish pistons

Reface valves and

hundreds of other

jobs



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### FRACTIONAL HORSEPOWER Motors

Thousands of Dumore Motors are now rendering superlative service in floor polishers, oil burners, in delicate calibrating machines—in many products and many fields.

An increasing number of manufacturers whose products demand the use of vibrationless, trouble-free, dependable motors are adopting them.

Designed and built to meet almost any speed requirements, in sizes up to  $\frac{1}{4}$  horsepower, dynamically balanced to eliminate all vibration and constructed to precision limits which insure unusually long life, Dumore Motors are unquestionably the last word in small motor manufacture.

To manufacturers whose products require the use of small motors of the high speed universal type, this company can offer a distinctive service. An inquiry will bring you the close cooperation of both our Sales and Engineering Research Departments.

**WISCONSIN ELECTRIC COMPANY**  
48 Sixteenth Street, Racine, Wisconsin

# DUMORE

TRADE MARK—REG. U. S. PAT. OFF.

### The Back Yard Astronomer

(Continued from page 367)

from a camera repair man for only 15 cents.

"I had a ring of brass made to hold the objective. Quarter-inch brass works nicely. This was attached by means of a right angle of brass to the heavy (one by two inch) wooden beam of oak.

"The eyepiece tube was made of a piece of one-half inch pipe and a cap to fit, both of brass. A four-inch piece of pipe is long enough. A hole is drilled in the center of the cap, to finish the eyepiece. The lenses are put in the cap, one on top of another, and pieces of sealing wax hold them in very well."

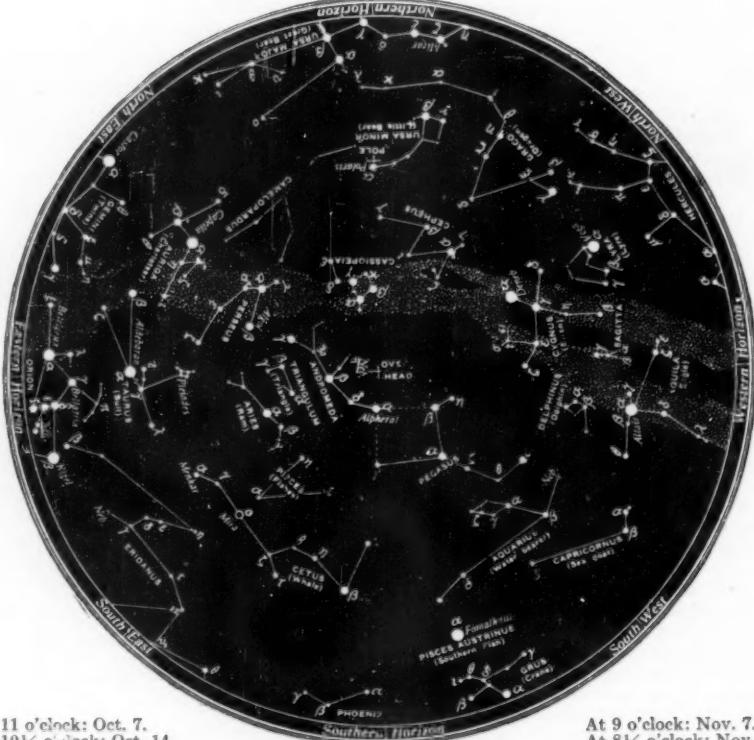
Mr. Clish next describes his mounting, details of which are, however, made sufficiently clear in the photograph. The eyepiece is attached to a piece of wood which slides on the main bar, and is held in place by means of two metal guides.

"The tripod," Mr. Clish continues, "is easily made from stock one and one-fourth by three-fourths of an inch. My instrument magnifies about 30 diameters. I can see four of Jupiter's satellites. The mountains on the Moon show up very well. I can count about 60 stars in the Seven Sisters. I am certainly glad that I built the telescope. It has given me much pleasure."

—A. G. I., Tel. Ed.

## The Heavens in October

By PROF. HENRY NORRIS RUSSELL, Ph.D.



The hours given are in Standard Time.

### NIGHT SKY: OCTOBER AND NOVEMBER

**MERCURY** is an evening star until the 24th and a morning star afterward. He is, however, too near the Sun to be seen except at the beginning of the month when he may be glimpsed low in the twilight just after sunset.

Venus is likewise an evening star, but being far brighter than Mercury, should be equally visible. On the 1st the two planets are in conjunction, Mercury being  $3\frac{1}{2}$  degrees south of his brighter neighbor.

Mars is in Gemini and rises about 9:30 P.M. He is still some 80,000,000 miles away but is rapidly approaching us and growing brighter. He already exceeds all the stars but Sirius.

Jupiter is in opposition on the 28th and is visible all night long. He is near perihelion and his distance from the Earth, 370,000,000 miles, is about as small as it can be. This makes him unusually bright—

more than twice as bright to our eyes as Sirius. His position in the sky in Aries, far from any bright star, makes him the more conspicuous.

Saturn is in Scorpio and is an evening star setting about 9:00 P.M.

Uranus is just past opposition and well placed for telescopic observation; while Neptune is a morning star rising about 2:00 A.M.

The Moon is in her last quarter just after midnight on the 6th; new at 11:00 A.M. on the 13th; in her first quarter at 4:00 P.M. on the 21st, and full at 6:00 P.M. on the 28th. She is nearest the Earth on the 1st, farthest away on the 17th and at her nearest again on the 30th. During the month she passes by Jupiter on the 1st, Mars on the 5th, Neptune on the 9th, Mercury on the 15th, Venus on the 16th, Saturn on the 18th, Uranus on the 26th and Jupiter again on the 28th.

**The Scientific American Digest**

(Continued from page 352)

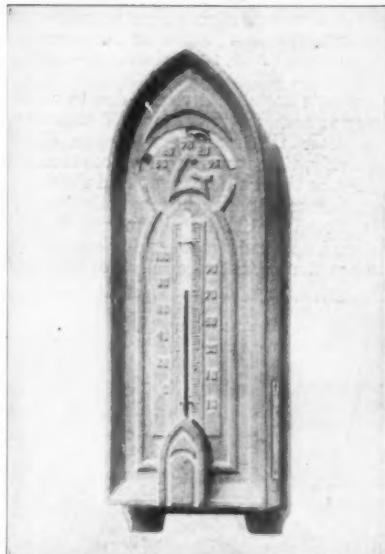
and has a platform supporting a light steel bridge which extends to the bank.

Since there is no railroad near the power house end of the dam, and the cost of a highway connection would be prohibitive, it was decided to have the machinery delivered by barges. A gantry crane of 15 tons capacity which travels on the walls of the building, was therefore erected for handling the machinery, and for future repairs or replacements. With this arrangement, material is picked up from barges, carried to the proper position and lowered through roof hatches into the building. This crane also carries a rake for clearing the trash racks.

The designing and engineering supervision of the construction of this plant for the Kentucky Hydro-Electric Company was in charge of L. F. Harga, consulting engineer of Chicago, and the general contractor was the L. E. Myers Company of Chicago.

**Ingenious Furnace Control**

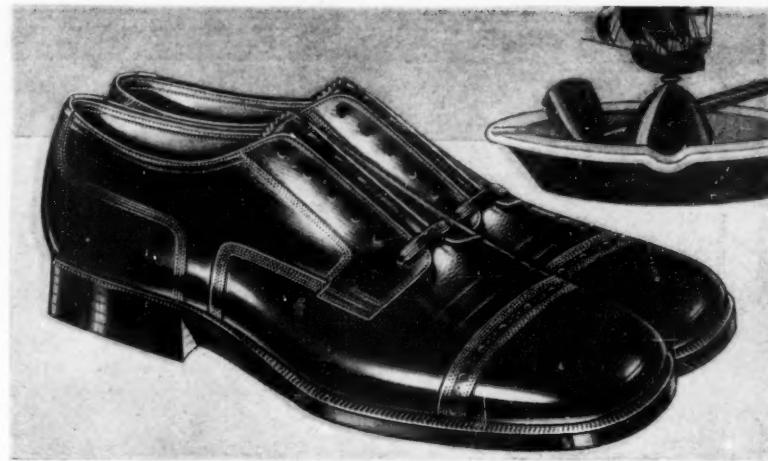
ONE of the essentials of present day comfortable living is a positive automatic control for the furnace. There are many devices on the market which accomplish this work, but it is interesting to note one in particular which has a number of well-conceived features. This arrange-



Exterior of the thermostat of the furnace control showing thermometer and the setting pointer

ment, illustrated in these columns, is the product of the Germeyer Engineering Company. It consists of an electrically driven air blower, an automatic thermostat, and a contactor which in itself is unique in design and construction.

Two different types of motors can be obtained for use with this installation: one of variable speed and the other of constant speed. The motor driven blowers will deliver a maximum volume of 250 cubic feet of "free air," of about 225 cubic feet against one inch static pressure, while the shut-off pressure is about  $3\frac{1}{2}$  inches. Because of the special construction of the motors, there is practically no possibility of



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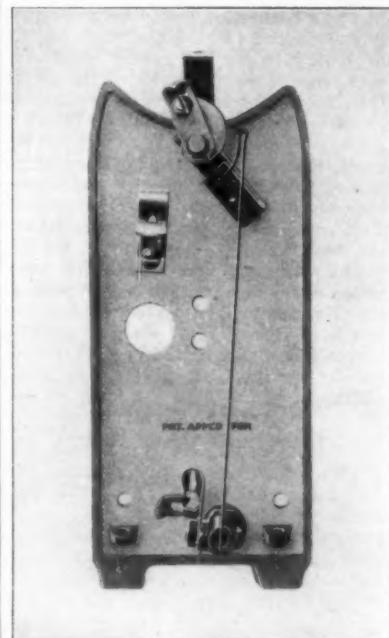
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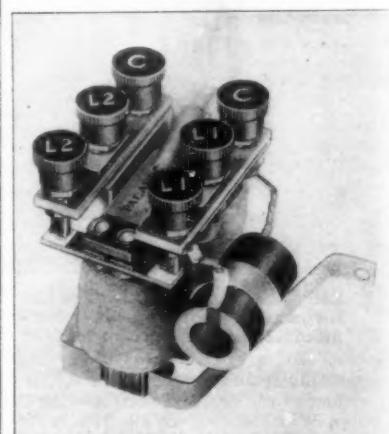
interference with radio due to sparking.

The thermostat employed is extremely simple but it has a magnetic arrangement which is worthy of mention. A permanent magnet sets up a constant field around the crescent-shaped contacts. When these



Thermostat showing crescent-shaped and arm contacts—open

contacts are almost closed due to a reduction in heat, the magnetic field causes them to close the remainder of the distance quickly, thus insuring a firm contact. Likewise, as the room heats up and the thermostat tends to open, the magnetic field holds it closed until the thermostat arm has stored up considerable spring energy; then when the contacts are released, they spring



The combination transformer and relay with its binding posts

apart quickly, eliminating any possibility of an arc.

The contactor employed is a combination transformer and relay. Two coils are wound on a "U" shaped core and placed beside them is a resistance coil wound on a bobbin. This resistance is in series with one coil and with the current supply line. Thus a magnetic flux is generated and the arma-

ture is attracted to the pole piece. When the thermostat contacts close, a current flows in the other coil on the "U" shaped core, partially counteracting the flux set up by the other coil. This action releases the armature and closes the main contacts to the motor circuit. No batteries or other source of current supply than that which supplies the motor, is necessary with this furnace control apparatus.

The draft unit has an automatic damper on the inlet, which closes when the blower stops. This prevents air from being drawn in by natural draft and the resulting overheating of rooms; it also makes possible the use of any kind or size of coal and of coke, and prevents waste of fuel.

This automatic control may be installed on any type of heating system and regulated at any convenient part of the house by means of the thermostat.

#### Special Process of Chromium Plating Resists Heat

INQUIRIES continue to reach us concerning the protective value of chromium plating. Recently a correspondent wanted to know if chromium might be applied to wire fencing which was subjected to the menace of brush fires, et cetera. It is generally known that galvanized fencing, after once being burned in a fire of this kind, or bent and turned by farm implements, rapidly rusts and, in time, fails entirely.

A report we have recently received states that chromium can be applied to wire fencing at a cost of only about 100 percent more than that of ordinary galvanized wire. The report is as follows:

"By use of Madsenell coating methods, an absolutely tight coating of nickel, chromium, or zinc is obtained. In ordinary methods of coating, nickel is put on copper and then chromium on top of the nickel. Where any heat resistance is needed, these coatings peel readily from the steel."

"Madsenell coated sheets and wire have been tried in an enameling furnace which is constantly maintained at a temperature of 1600 degrees for as much as 500 hours and with this very severe test, the coatings have never peeled and were only slightly oxidized."

"The cost of nickel and chromium coated wire would be 100 percent more than the ordinary galvanized wire which rusts out in a very short time and will not stand any great amount of heat."

#### Industrial Use for Cottonseed Hulls

COTTON and cotton products are used for many and varied purposes, and now a unique use for cottonseed hulls—usually utilized for cattle feeding—has been developed.

Hundreds of new oil wells have recently been drilled in the fields of west Texas, in Crane, Pecos, and Winkler counties. A big problem in the drilling of wells is that of side-wall caving before the casing is set in the wells. Recently it has been discovered that a few tons of cottonseed hulls poured in a well, at about the depth of possible caving, will prevent caving as drilling continues. Moisture expands the hulls and this, combined with the force of the drill, forces the hulls to the side-wall in a tightly compacted mass which stops the caving tendency, thus saving a great deal of time and money.

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### Learning to Use Our Wings

(Continued from page 356)

motorcycle until flight started. Glen Curtiss, another great pioneer, built the first flying-boat glider in 1922, with which some glides were made at Port Washington, a fast motor boat being used for towing.

Outside of these rare attempts, gliding in the United States is conspicuous by its absence.

This year, it is encouraging to learn, the American Motorless Aviation Club has been formed, mainly by the efforts of J. C. Penney, a young American sportsman. This club has brought over three young German pilots, Peter Hesselbach, Captain Paul Roehre, and Dr. Paul Laubenthal. With these pilots came three gliders, one of which is similar to the famous Darmstadt glider, which holds the world's soaring flight record of 14 hours 23 minutes, and the world's altitude gliding record of 2715 feet.

A serious attempt is to be made to overcome the great handicap to American gliding, namely the absence of suitable topographical and meteorological conditions near the great centers of population. The successful endurance glide is not a mystery. Sustained gliding is possible only when there is available a steady and fairly powerful upward current, which allows the glider to perform a steady downward glide relative to the air, while it remains parallel to the earth, or even climbs. Aerodynamic efficiency of the glider and the utmost skill in piloting are of no avail if these basic conditions are not found.

After much searching, the American Motorless Aviation Club selected Corn Hill, near Provincetown, Massachusetts, as an ideal location, where a hill that forms a continuous ridge, and sea breezes a promise of steady upward currents.

Paul Hesselbach has been selected as the first man to try to break the endurance record in the glider. His attempts will apparently not be without some danger. Corn Hill not providing a satisfactory breeze, the glider was transported to Highland Light on the ocean side of Cape Cod. At this point there is a precipitous embankment of 1400 feet sheer drop. Hesselbach's glider was placed near the edge of the cliff and catapulted by 10 men manipulating a rubber "slingshot." The wind was not strong enough to sustain the glider after it was catapulted, and it settled dangerously near the edge of the cliff. Only a skilful tilting maneuver prevented a dangerous fall over the edge. We hope that ensuing attempts will be more successful.

It may be of interest to our readers to review the present status of glider construction as it has developed in the many German meets. Apparently gliders have now evolved into three distinct classes, as demonstrated by the Rhön-Rossiter meet of 1927.

There is first of all the "school" glider, the purpose of which is to give the pilot his initiation into the art of gliding. In such a glider, aerodynamic refinement may be largely dispensed with. It should be, above all, inexpensive and easily repaired after being damaged in poor landings.

All the school gliders are high-wing monoplanes, with skeleton fuselages. The pilot's seat under the wing is entirely unprotected and has no obstruction in front of it. This type of construction is said to lessen the liability of injury to the pilot by splinters

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in the event of a crash. Also, since the pilot has no reference line to fly by, this type of glider has value as a means of training to fly by feel. A pilot after flying such a glider would know how to act even when deprived of adequate flight instruments. Since aerodynamic advantage is a minor consideration, school gliders have a low aspect ratio, that is, a low ratio of the span or spread of the wing to its chord or width.

In the second class, the "training" glider, a high-wing monoplane is also employed. But the fuselage is now enclosed, thus reducing its resistance. The aspect ratio is still only six to one, but nevertheless these training gliders have made quite long glides in the hands of skilled men. We append line drawings of a typical training glider, which has a span of 32.81 feet and an over-all length of 18.04 feet.

Finally we have the "contest" gliders, in which every effort is strained to develop aerodynamic efficiency. To this class belongs the famous Darmstadt glider. The fuselage is now of perfect streamline shape, with a delicately rounded bow. There are no struts or wires to brace the cantilever monoplane wing. Finally the wings have the enormous spread of 59 feet, with an average chord of something like two and one half feet, giving an aspect ratio of over 20. This is conducive to the greatest efficiency in soaring, but it also means a somewhat heavier weight empty than in the training or school gliders. The Darmstadt glider when empty weighs 331 pounds, which is surprisingly high for a glider.

### An Altitude Record

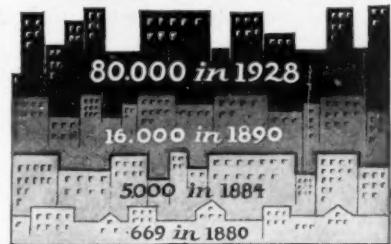
**R**ECORDS in aviation come so frequently that it is hard to keep track of them. Still it is interesting to learn that the Navy flying boat, the *PN-12* has flown to a height of 18,500 feet with the greatest useful load ever carried to such an altitude.

The plane was actually weighted with 4200 pounds of zinc bars. It was piloted by Lieutenant Arthur Garvin. The boat is powered with two powerful Hornet engines, and has the now conventional, but none-the-less beautiful, hull lines, with a sharp bottom line, and a flattened V prow.

### Tail Trimming Flap

**I**N the typical modern airplane, the stabilizer is made adjustable in the air. The front spar of the stabilizer hinges from a support on top of the fuselage, and the rear spar is made to move up or down by means of a threaded bolt and a nut, the bolt being turned by a cable running to a handle in the pilot's cockpit. The adjustment of the stabilizer serves to trim the plane for various load and flight conditions. The provision of an adjustable stabilizer introduces a certain amount of weight and complication. The French Nieuport company has recently patented an alternative trimming gear which has possibilities. The contrivance consists of a pair of narrow, hinged flaps along the leading edge of the elevators. The flaps are controlled by a worm gear and cable. Raising the flap on the upper surface is equivalent to turning the front edge of the stabilizer down. Projecting the flap on the under surface is equivalent to raising the front edge of the stabilizer. The arrangement is certainly simpler than the process of adjusting the entire stabilizer.

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What rare combination of industrial advantages is responsible for this unusual growth? What brought the world's largest artificial silk (rayon) mill to Roanoke? Why is Roanoke the location of 113 different industries—with some plants here the largest of their kind in the South? Why is Roanoke the distributing center of some of the country's leading manufacturers?

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*By Howard T. Barnes, Prof. of Physics, McGill Univ.*

PROF. BARNES will be remembered as occupying much space in "the news" two winters ago when he broke up an ice jam which threatened the extinction of Oil City and Franklin, Pa. This, however, was only one of many such accomplishments. This book records the results of 20 years experimentation covering also ice navigation and icebergs. It makes most interesting reading aside from the fact that it is the only engineering treatise on the subject. \$5.20 Postpaid

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*By V. Blasco Ibanez*

THOSE who enjoy this author's writings will be interested in reading this early work of his which is considered one of his best unconventional love stories. \$2.50 Postpaid

**Industries From Atoms**

(Continued from page 365)

jectionable smoke. The boiler was then equipped with air control devices. A second series of tests with the changed boiler showed a decided reduction in the smoke produced and an increase in efficiency of from 1 to 4 percent.

**The Menace of Increasing Population**

(Continued from page 340)

consider the physical difficulties in South America of conquering their river systems, and the political difficulties in Russia and in Asia to be overcome, before dense populations can be there developed.

Thus one sees that migration is not merely a problem of absolute or even of relative densities, *viz.* of the ratio of existing to possible populations under given conditions, but embraces most complex systems of relation depending upon human characters, states of culture, ideals and development. It is a problem of simple character only to those who have given it no serious consideration.

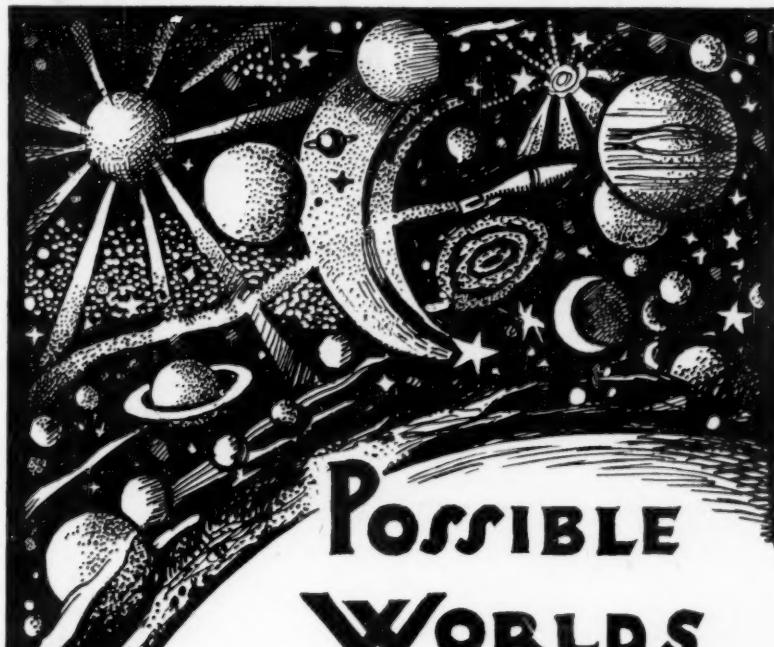
At the same time it is eminently desirable that a commencement should be made by way of ascertaining thoroughly the possibilities of the whole situation. This will take time and will involve world-wide efforts on some definite plan to be mutually agreed upon, *if possible*. The question involves international difficulties, the nature of which will suggest themselves to any political thinker, and which we cannot discuss here.

To sum up: The rate of population increase; the elevation of our standards of living; the growing rapidity with which our forests, our coal and oil fields, our iron, copper, zinc, tin, and aluminum mines are being exploited; and our increasing difficulties in insuring adequate supplies of food-stuffs, are such as to challenge our attention. Anyone who has any interest in the future of his nation for even the existing century, is called upon to consider the issues of human increase and to recognize that we are faced with a problem of supreme difficulty, a problem to which publicists and economists may well give their profound attention.

An avalanche of trouble threatens; is it to sweep us into appalling disasters? Migrations are merely a palliative, for human reproductive forces perpetually tend to re-establish the pre-existing populations and to increase them. The mere fact that an annual 1 percent increase means an addition of 10,500,000 to the world's people, and that that rate has recently been exceeded, commands our attention.

The 1910-1920 rate of increase for the United States, were it continued to the year 2000, would in the 72 years add no less than 200,500,000 to its population. Such a fact demands that we give it consideration.

If ever we are able to transfer the enormous costs of preparations for war or defense to studies of social economics and to scientific research and its applications to the well-being of man, the load may be lightened. But even then the reproductive urge will tend to re-establish the acuteness of the problem, namely, how may we meet the needs of human increase?



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# Commercial Property News

*A Department of Facts and Notes of Interest to Patentees  
and Owners of Trademark Rights*

## Good to the Last Bite

THE Cheek-Neal Coffee Company has built up a tremendous business in coffee through spending millions of dollars in advertising their trademark "Maxwell House" and their slogan "Good to the Last Drop." The fact that the business was sold not long ago for twenty-seven million dollars is some evidence of the value of the trademark and the slogan. Probably they would be good for some other business, as well.

Whatever its motive, the Hal Dick Manufacturing Company, of Knoxville, Tennessee, applied at the Patent Office for registration of a trademark consisting of a composite picture including the representation of a hotel, the words "Maxwell House" and the slogan "Good to the Last Bite." This mark they are using for horse-radish, olive spread, cranberry jelly and large number of similar goods. The Cheek-Neal Company opposed the registration, but First Assistant Commissioner Kinnan allowed it, stating, however, that registration would have been refused had there been any element of doubt in the case. He said:

"The applicant's goods are in no sense beverages as are the tea and coffee sold by opposer, but belong to the class of salads and relishes, and it is believed there is no warrant for holding the goods of both parties possess the same descriptive properties or belong to the same class, as such terms are used in the trade and have been interpreted or construed by the courts in previously adjudicated cases. While not unmindful of the fact that the registration of opposer's mark by others upon different classes of foods tends to destroy the distinctiveness of opposer's mark and to an extent may be said to damage opposer, yet, under the statute, the only ground upon which refusal of registration to such applicants can be based is that the goods possess the same descriptive properties."

In the case of American Tobacco Company, Inc., versus Gordon, the Court noted that merchandise possesses the same descriptive properties in a statutory sense when the general and essential characteristics of the goods are the same, and noted that the "statute must be taken as it is found." It seems impossible to hold that opposer's coffee and tea belong to the same class as the relishes and salads upon which the applicant applies its mark, and since this is the only statutory basis for sustaining the opposition, the opposer must fail."

## The Fountain Pen Invention

WHO is the inventor of the fountain pen?

Lewis E. Waterman?

No, indeed. He was a late comer in the field when he applied for a patent September 19th, 1883. King Tutankhamen's secretary probably had been using one long before Waterman.

Excavations in an Egyptian tomb dating back more than 4000 years, according to

the *Journal of the Patent Office Society*, shows an early form of fountain pen. The primitive instrument consisted of a section of reed of the diameter of a lead pencil, about three inches in length and mounted on a long piece of copper. The nib of the pen was cut away to a fine point like an ordinary quill pen. The narrow tube of the reed served to hold in reserve a small quantity of the writing fluid, whatever it may have been.

The earliest writing fluid, it is now thought, was probably applied by means of a brush in Egypt and in China. The brush required frequent dipping into the fluid, which may have led to the idea of a

Waterman's invention provided an ink duct with longitudinal fissures in the side, the gradual decrease in the size of the tube toward the nib providing against the excessive flow of ink. The groove being in direct contact with the pen, a sufficient quantity of ink was supplied. Waterman, by the way, used ordinary pen points which he bought from other manufacturers. Soon after he obtained his patent he assigned it to his wife. She then leased the exclusive manufacturing rights to him, in return for which he paid her a royalty of 25 cents per pen.

## Monopolies on Narrow Inventions

IT is by a very narrow margin indeed that some devices are called inventions and are granted patents. The Walten patent for an automobile tire flap is probably as narrow an invention, if invention it be, as any that has been issued, and yet the Court of Appeals of the District of Columbia has been reversed in its decision dismissing a suit on the ground that the patent was void for lack of patentable novelty.

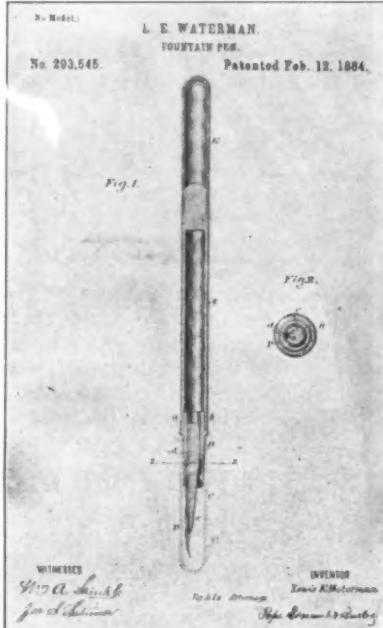
The patented device is a full length tire flap with a perforation at one end to fit over the valve stem of the inner tube and provided with marks showing where perforations for adjustment should be made at the other end. When Tingley and Company, controlling the patent, put the flap with the markings on the market, imitation speedily followed. Suit for infringement was brought against the Badger Rubber Works.

"Because there were five sizes of tires," says Judge Page, writing the majority opinion for the Circuit Court of Appeals for the Seventh Circuit, "it was the practice, and, so far as known prior to Walten, necessary, to manufacture, and the dealer had to carry, a supply of flaps in each of the five lengths. What Walten sought to do was to make one flap that could be easily altered by anyone so that it would not be necessary to manufacture or carry in stock the five sizes theretofore made and carried. Some of the difficulties to be overcome in accomplishing his purpose are pointed out in the application."

"Whether the many millions of automobiles, which we know as a matter of common knowledge have been manufactured during the last 30 years, used with each of their four wheels a tire flap, we do not know, but the number that must have used them is so large that the desirability of reducing the number of tire flaps to be carried in stock we think is apparent. The haste with which appellee adopted Walten's flap is some evidence that the trade approved such a change."

Judge Evans dissents heartily from the decision, declaring:

"Appellants' improvement is in supplying 'indicia for aperturing said inperforate portion to make the flap any one of a plurality of sizes.' In other words, the flap described in the patent is provided with marks which inform the user where he



Reproduction of the drawings accompanying Waterman's patent

pen which would hold a considerable amount of fluid.

By the time Waterman made his invention, fountain pens were so well known that all he claimed was "certain new and useful improvements in fountain pens." He says in his specification:

"My invention relates to that class of fountain-pens in which the nib of the ordinary writing-pen is supplied with fluid ink from a barrel or reservoir, which may conveniently form the handle or holder of the pen.

"The object of the invention is to secure and automatically regulate a certain and uniform flow of ink to the pen, and also to prevent the excessive discharge of the ink when the pen is in use. By my invention a fountain-pen composed of but comparatively few parts is produced, and the general construction of this class of pen greatly improved and simplified."

may cut additional openings in the flap to make it shorter.

"Clearly it would not constitute invention to make places in a belt through which holes might be cut to make the belt shorter. This, it seems to me, is all that Walten did."

"I cannot believe that there was any patentable novelty which can be ascribed to the use of an expedient so simple and commonly used for shortening the usable portion of a belt, strap, flap, or other similar article. What any 10-year-old boy, upon finding his older brother's belt too large, would do with his jack-knife, would hardly be called an inventive discovery."

#### Inventors Should Be Practical

**A**N inventor sent to us recently a description and sketch of a device which well illustrates a common fault of amateur inventors—that is, it is not in complete harmony with public habits and tendency. This device he called a "Carry-All." Made of silver or aluminum, it was intended to contain the entire miscellany of articles usually carried in all the pockets of the ordinary man. It can be carried in the inside coat pocket or the hip pocket. The interior included the following compartments:

1. Smoking service: cigar, mouthpiece, match with a relative lighter.
2. Toilet service: mirror, comb, nail file, smelling bottle.
3. Writing service: pen, pencil, eraser and ink bottle.
4. Precision instruments service: watch and compass.
5. Pocket book service: documents, private notes, secrets, souvenirs and bank notes.

For the American rights to the invention the inventor asks 5000 dollars. In our opinion manufacturers probably will not rush to him in great numbers. The average man does not carry smelling bottles, ink bottles, compasses and other things which the inventor has provided for. And when a man reaches for a pencil he wants to find it in his vest pocket and not inside a carry-all in some other pocket. An invention is more likely to win out if it caters to people's habits rather than if it tries to change them. The most successful inventor is the one who thinks and acts like his fellow-men but just a little ahead of them.

#### The Balloon Tire Patent

**T**HE claims of the famous Putnam patent for balloon tires have been held invalid by the Federal District Court for Eastern Michigan. The suit brought by the Steel Wheel Corporation has been thrown out of court and the B. F. Goodrich Rubber Company is allowed to make its fifty-odd sizes and constructions of balloon tires without molestation.

"Putnam was not the bell cow who led the entire herd and all the different herds along the highway down to the 'balloon' tire barn, with its luxurious beds," says Judge Tuttle, "but was merely one of the many cows who had seen the 'balloon' tire barn in the distance and had journeyed down that way and were gazing around outside of the barn for quite a while before the tire and rim men in charge of the barn opened the door. When the door was

opened the others all went in with a rush.

"The tire industry and the automobile industry have their associations for standardizing tires, rims and devices of that character. That such things should be standardized is for the convenience and for the advantage of the public and is economically helpful to the world. But in an industry which is thus standardized and in

which the decision with regard to changes rests with comparatively few people, changes are apt to take place suddenly when those in control open the door to them."

Judge Tuttle gives an interesting history of balloon tires in his opinion. One of the first to make practical use of the advantages to be derived from relatively wide pneu-

## Patents Recently Issued

### Classified Advertising

*Advertisements in this section listed under proper classifications, rate 25c per word each insertion; minimum number of words per insertion 24, maximum 60. Payments must accompany each insertion.*

*Official copies of any patents listed in this section at 15c each; state patent number to insure receipt of desired patent copy.*

#### Pertaining to Aeronautics

**S**OARING HELICOPTER—Which may be propelled manually and elevated vertically, is provided with foldable wings for soaring, and requires but a minimum of effort for the lifting purposes. Patent 1680175. A. Rudy, 412 McKinney Ave., Houston, Texas.

#### Pertaining to Apparel

**SHOE INNER SOLE**—Which is not only a corrective but serves to maintain a good fit in a normal state, and do away altogether with commonly used arch supports. Patent 1677105. B. J. Silver, c/o Milburn Hotel, 242 W. 76th St., New York, N. Y.

**SUPPORTING LOOP FOR GARMENTS, ETC.**—Of the type formed from a single length of resilient wire, shaped to provide a lower button engaging loop, and an upper strap engaging bar. Patent 1677078. R. E. Garrett, c/o F. J. Schubert, 213 Reidhurst Ave., Nashville, Tenn.

**INFANT-NAPKIN PROTECTOR**—To be worn by infants to form a protective covering for the usual diaper, which by its form permits the freedom of movement of the limbs. Patent 1680178. Flora M. Shafer, 8159 Lefferts Ave., Kew Gardens, L. I., N. Y.

#### Chemical Processes

**PROCESS OF PURIFYING SUGAR SOLUTIONS**—Which consists in heating a sugar solution to approximately 90° C., adding a prolific quantity of lime for decolorization, neutralizing by means of a suitable acid, and filtering. Patent 1678571. F. W. Meyer, c/o G. Hirschfeld, Alexandrinestrasse 134, Berlin, S. W. Germany.

**MEANS FOR TREATING HOLLY AND LIKE PLANTS AND PRODUCTS DERIVED THEREFROM**—An apparatus for receiving the holly leaves that they may be treated to produce extracts available as a beverage, or for medical purposes, and the by-product used for cattle food. Patent 1679525. S. M. Hoye, 594 5th St., Brooklyn, N. Y.

#### Designs

**DESIGN FOR A FINGER RING**—Patent 75406. G. Bartiromo, 417 Jewelers Exchange Bldg., Los Angeles, Calif.

**DESIGN FOR A ROUGE BLENDER**—Patent 75501. Helen Leyne, 5785 Moshulu Ave., Bronx, N. Y.

**DESIGN FOR A BUILDING**—Patent 75511. G. H. Natzel and F. E. Jackson, Santa Ana, Calif.

**DESIGN FOR A LOUD SPEAKER OR THE LIKE**—Patent 75554. P. H. Fuller, Lefurgy Ave., Dobbs Ferry, N. Y.

**DESIGN FOR A LOUD SPEAKER**—Patent 75558. R. Y. Günther, 6034 Hollywood Blvd., Los Angeles, Calif.

**DESIGN FOR SHOE**—Patent 75681. T. J. Fitz Harris, c/o Franklin Simon & Co., 38th St. and 5th Ave., New York, N. Y.

**DESIGN FOR A BOUDOIR SLIPPER**—Patent 75757. H. Wilhelm, c/o Bernard Bernbaum, 1440 Broadway, New York, N. Y.

**DESIGN FOR A CUFF BUTTON OR SIMILAR ARTICLE**—Patent 75807. F. C. Rile, 6022 Calumet Ave., Chicago, Ill.

**DESIGN FOR A WALL-PAPER PANEL OR THE LIKE**—Patent 75794. H. L. Hoffman, c/o R. E. Thibaut Co., 24 W. 40th St., New York, N. Y.

**DESIGN FOR A WALL BRACKET**—Patent 75801. C. Lehrman, c/o Levolite Co., 176 Grand St., New York, N. Y.

**DESIGN FOR A BOTTLE OR THE LIKE**—Patent 75763. R. B. Annis, c/o Mower-Gulden Annis Co., 87 34th St., Brooklyn, N. Y.

**DESIGN FOR A COMBINATION BATH FIXTURE**—The inventor has been granted two patents of a similar nature. Patents 75819 and 75820. J. H. Balmer, 259 Plane St., Newark, N. J.

**DESIGN FOR A COAT**—Patent 75826. Katherine E. Burns, c/o Franklin Simon & Co., 38th St. and 5th Ave., New York, N. Y.

**DESIGN FOR A STOCKING**—Patent 75846. A. M. A. Hoffman, 136 Mineral Spring Ave., Passaic, N. J.

#### Electrical Devices

**INDICATOR SWITCH FOR RADIOCIRCUITS**—A signal light, whereby the operator knows whether the circuit is on or off by merely seeing whether the light rays are projected through the hollow switch arm. Patent 1673876. A. C. Koeppler, 4928 Henderson St., Chicago, Ill.

**RADIODIAL**—Equipped with a visible indicator which becomes active whenever the dial has been rotated to the proper point to bring in station. Patent 1674603. H. Matzner, 24 Nathon Davis Place, New York, N. Y.

**ADAPTER AND PLUG FOR CUT-OUTS**—Wherein a specially prepared fuse plug may be used in any ordinary screw socket, the parts being so constructed as to prevent a wrong size being used. Patent 1675637. W. P. Briggs, Municipal Bldg., New Bedford, Mass.

**STEAMING IRON**—An electric heating element wherein the current passing through water from one electrode to another makes the water flash into steam without the accumulation of water. Patent 1676098. R. Leprestre, 1158 Fifth Ave., New York, N. Y.

**MOTOR CONNECTION INDICATOR**—Particularly adapted for use in connection with three phase motors, where the windings are connected for current of 220 or 440 volts, and it is desired to reconnect the winding from 440 or 220 volts. Patent 1675019. H. W. Beaver, 1355 Portia St., Los Angeles, Calif.

**ILLUMINATED DIAL**—Which may be readily applied to the cabinet of a radio apparatus and

matic tires at correspondingly reduced inflation pressures, he finds, was the Palmer Tyre Company, Limited, a British concern whose product was known as the Palmer Cord Tyre. Beginning as early as 1908, the company's literature and trade journals described the increased riding comfort of wide, soft tires, in language that would fit exactly the present-day balloon tire.

Three years before Putnam's patent issued, the Hawley patent had been applied for, December 10th, 1917. It disclosed fully the advantage of a wide, thick, soft tire, which is what Putnam claimed when he filed his application, August 3rd, 1920.

More than a year before Putnam's application was filed, the French patent to Perrot for a balloon type of tire was published. Not only that, but R. K. Mulford had been using Goodyear airplane tires on his small cars in 1917 and 1919, a use which the judge declares is sufficient in itself to invalidate the Putnam patent.

Summing up the entire patent situation, Judge Tuttle says:

"There is not the slightest doubt in my mind as to the value of the 'balloon' tire in the way of comfort, economy, and length of tire life. If we disregard the intermediate steps which have occurred and compare the wide, soft, easy-riding 'balloon' tire of today, with the narrow, highly inflated, hard-riding tire of yesterday, and by 'yesterday' I mean a time far enough back to avoid all contentions and disputes, and all prior uses, prior publications and prior patents in this record, we cannot fail to be impressed with the great practical importance of the advance that has been made. Had that advance been made in a single patent, there could be little doubt of the presence of the inventive genius in that discovery, or of the validity of that patent.

"However, the advance to the 'balloon' tire has not been made in a single step, but step by step, as the industry has developed, and the Putnam patent here sued upon discloses no 'discovery' whatever, but merely what was well known in the art, and repeatedly published during more than a decade preceding Putnam's application date."

#### Invention as a Remedy for Unemployment

**I**N a way, invention, through labor-saving machinery, has caused some of the present unemployment, and in my opinion, new invention is one of the only ways to cure it."

So declared Honorable James J. Davis, Secretary of Labor, recently. The Secretary, of course, does not mean to imply that all labor-saving machinery brings about unemployment. Such a sweeping generality would be just as inaccurate as to say that no invention ever throws men out of work. To how great an extent labor-saving machinery has resulted in unemployment is a matter for theorists to discuss. That the development and manufacture of new products would put men to work is self-evident.

Fortunately, the remedy for unemployment which Secretary Davis suggests already is being applied. Patent attorneys have had a steady inflow of inventors seeking to patent their ideas. This unusual demand for patent attorney services has existed since the first of the year. Within six months it will begin to show an increased volume of patent business issuing

connected to the various parts, without appreciably illuminating the surrounding objects. Patent 17017 (Re-issue). W. C. and F. Buchholz, c/o Frank Buchholz, 87 Penn St., Brooklyn, N. Y.

**ELECTRICAL CONTACTOR**—In the nature of a clip, to which the conductor wire is so applied that direct contact of the surfaces for radio or lighting may be obtained. Patent 1677059. P. M. Tebbs, 1617 Forster St., Harrisburg, Pa.

**ELECTRICAL HEATING AND COOKING APPARATUS**—A bendable unit which may be given any desired shape for generating heat so that surrounding fluids, whether gaseous or liquid, may be heated for practical purposes. Patent 1677032. J. W. J. Kaffer, Kerkstraat 81, Meester-Cornelis, Java, Dutch East Indies.

**DISPLAY DEVICES**—Having a backing which lies flat when collapsed, but can be quickly secured upright, and spaced, for holding an electric light to illuminate a picture. Patent 1677840. L. Moses, c/o Wolf Advertising Co., 45 West 18th St., New York, N. Y.

**ELECTRIC LAMP**—An incandescent lamp having a concave reflector for directing the rays of light in the manner of a spot light at a considerable distance. Patent 1678606. G. C. Singer, c/o United Land & Irrigation Co., Brownsville, Texas.

**ELECTRIC WELDING TONGS**—So insulated as to prevent arcing except at the welding electrode, thereby preventing accidental arcing resulting in serious injury to the operator. Patent 1677306. C. L. Stancillif, 2332 Chester Ave., Bakersfield, Calif.

**TIME-CONTROLLED CIRCUIT CONTROLLER**—An electrical circuit controller capable of being applied to any conventional form of alarm clock without modification of the construction of the clock. Patent 1678217. R. R. Gonsett, 1269 So. Cochran Ave., Los Angeles, Calif.

**LEAD STORAGE BATTERY**—Of strong construction, having greater capacity for a given volume, and means for permanently sealing the battery. Patent 1678224. A. Kastelic, 311 23rd St., Richmond, Calif.

#### Of Interest to Farmers

**REINFORCEMENT FOR BEE COMBS AND COMB FOUNDATIONS**—Which will prevent sagging and consequent distortion and breaking of the comb, on account of atmospheric changes, weight, or the stresses during handling or transportation. Patent 1674501. H. C. Dadant, c/o Dadant & Sons, Hamilton, Ill.

**STALK CUTTER**—Adapted to be drawn over a field to cut the stalks at predetermined small lengths, and means whereby to tilt the knives in a forward and downward inclination to effect the severing of certain stalks. The inventor has been granted two patents 1676105 and 1676106. J. F. A. and R. A. Michalka, c/o Michalka Bros., Cameron, Texas.

**CULTIVATOR, WEEDER AND DIGGER**—Including a wheel rotatably mounted on a frame and having a plurality of earth-working elements in the form of curved prongs. Patent 1677803. A. R. Tenger, Box 245, Marshfield, Oregon.

**IGNITION DEVICE FOR SMUDGE POTS**—Adapted for use in citrus groves, is normally inactive but upon a predetermined low degree of temperature becomes active to ignite the smudge for raising the temperature. Patent 1676368. J. A. Ulmer, 2501 East 52nd St., Huntington Park, Calif.

**FLY NET FOR HORSES**—A net-work of hemp or cotton thread to be applied to four-footed animals to frighten and prevent flies and other insects from troubling the animals. Patent 1677839. A. Montels, Aristobula del Valli 1782, Buenos Aires, Argentina.

**COTTON-BOLL BREAKER AND CLEANER**—Whereby the bolls are broken open and the cotton liberated from the burr, and subjected to the cleaning action of the beaters. Patent 1678210. F. B. Cumpston, Blooming Grove, Texas.

from the Patent Office. It is significant that the majority of these inventions are not for labor-saving methods, but are for new products to manufacture which will keep labor busy.

In regard to manufacturers: They are consulting all available sources for new articles of manufacture, things which will require the employment of additional labor. For example, here are two samples of such letters as this department has been receiving:

"When you have clients with inventions which have to be made principally of sheet metal, and who are looking about for a good manufacturing connection on a royalty basis, we would like to have you put them in touch with us. You can readily find out from Dun and Bradstreet, or any bank, that we are a large and reputable firm, financially responsible, and with a background of experience dating back to 1880. We are really in a position to deal to advantage with any clients whom you may see fit to refer to us."

"We would appreciate very much your placing our name on your list of manufacturers who desire receiving patents requiring screw machines, blankings, platings, et cetera."

Obviously, industry is just as anxious to find things to make and sell as inventors are to provide them, and it is especially fortunate that at this time there is plenty of money to finance new or extended undertakings. The forces to correct the existing period of unemployment are at work and it should be no great time before the industrial situation is back to normal.

#### Cross-Licensing by Uncle Sam

**I**N a memorandum to the heads of all government departments and establishments, Brigadier General H. C. Smith, the Chief Co-ordinator, announces a new policy having to do with licensing patents which the government owns or controls and cross-licensing of such patents with those owned by private corporations. He will have final power in disposing of all proposals for such licensing. The memorandum reads as follows:

"All proposals for the licensing and cross-licensing of patents owned or controlled by the government will be forwarded to the Chief Co-ordinator for reference to the Inter-departmental Patents Board, before which will appear such administrative and technical representatives as the department heads concerned may desire to designate. The findings and recommendations of the board will be submitted to the Chief Co-ordinator for his action and will have no force until approved by him. All subsequent allocations or modifications of licenses or cross-licenses will be handled in the same manner. Proposed revocations of any license will be reported to the Chief Co-ordinator."

It had been apparent that necessity existed for a co-ordinated policy with regard to such licensings and cross-licensings. To determine a policy which would safeguard the government and at the same time assure the co-operation of industry, a conference of representatives of executive departments was held. The memorandum setting forth the new procedure resulted from that conference.

**BROODER**—Having means for maintaining a correct temperature which increases gradually and regularly from the outer edge of the hover to a central source of heat. Patent 1679271. W. C. Sanctuary and W. A. Jones, 11 Cottage St., Amherst, Mass.

### Of General Interest

**DISPLAY BOX**—By means of which an article may be held against movement when the box is closed, and in display position when the box is opened. Patent 1673658. J. Andersen, 8715 178 St., Jamaica, L. I., N. Y.

**CAN OR SIMILAR ARTICLE**—Including a closure for the body and a lever fulcrumed on the closure adapted to bear against the body to facilitate removal of the closure. Patent 1673693. W. C. McLellan, 113 Milan St., Houston, Texas.

**PIPE COUPLING**—For connecting two flexible pipes, or a rigid and flexible pipe, yet maintaining fluid-tight joint and allowing rapid connection and disconnection. Patent 1673338. T. E. Mitchell, 325 Citizens Bank Bldg., Los Angeles, Calif.

**LOOSE-LEAF BINDER**—An adjustable back cover which is held in position on the inside sections by elements which also carry the binding straps and locking mechanism. Patent 1673315. F. H. Crump, 225 E. 4th St., Los Angeles, Calif.

**PENCIL-SHARPENING DEVICE**—In which the point is formed by the shaving action of a cutting blade, the device is adapted to use, although not necessarily, old safety razor blades. Patent 1672429. G. H. Schmidt, P.O. Box 31, Alhambra, Calif.

**EDUCATIONAL DEVICE**—Which will display to pupils various groups or columns of figures for addition, and in which many combinations of figures may be had. Patent 1674553. C. S. Jones, Clarkson, Neb.

**CLOTHESLINE HOLDER**—Having an automatic clamping member in the housing forming a part of the clamp, and so constructed that a reliable guide is formed for the rope. Patent 1674559. G. J. A. Molique, 2712 Denver St., Granite City, Ill.

**INSIDE SAFETY DOOR FASTENER**—Which may be conveniently carried about by travelers who wish an additional door fastener, and readily attached or detached from the stile of the door frame. Patent 1671454. E. H. Stoutenburgh, c/o M. Averill, 1615 Broadway, Oakland, Calif.

**MEANS FOR SECURING BARREL HEADS**—Comprising a ring forming channel members, a bevelled ring arranged on and surrounding the barrel end, and a bead which prevents the ring moving. Patent 1674578. A. H. Trageser and L. Hassinger, 447 W. 26th St., New York, N. Y.

**CAN TOP**—Having an easily releasable means for locking a pouring spout on the can top, making the can practically air tight, and preserving the contents. Patent 1674590. M. D. Cohen, 1001 Ind. Life Bldg., Nashville, Tenn.

**MERCHANDISE PACKAGE**—Wherein a large number of fragile inner containers can be stored and held out of contact for transit, within a greatly restricted area. Patent 1673956. A. B. Stewart, 315 W. 9th St., Los Angeles, Calif.

**FAVOR DISTRIBUTOR**—In the form of a light support, which has a receptacle made of sections adapted to be folded to conceal the favor, or render it accessible. Patent 1676137. W. E. Dodge, 315 W. Highland Ave., Shawnee, Okla.

**BUILDING MATERIAL**—Adapted for use either as a wall board, or as a metal lath, so constructed that plaster will be keyed to the material without danger of cracking. Patent 1677073. G. Cohen, 201 West 49th St., New York, N. Y.

**BREAD PROOFER**—An arrangement of drawers in such manner that they constitute a cabinet when closed, for resting the dough prior to molding into loaves. Patent 1677043. J. M. Morrill, c/o E. S. Farley, Atty., Milbank, S. D.

**RAZOR-BLADE SHARPENER**—Having a holder from which the ordinary "Gillette" or "Durham" type of blades, may be readily removed and replaced, in association with the conventional type of strop. Patent 1676209. W. W. Upington, 2702 No. Junette St., Tacoma, Wash.

**PORTABLE SOAP HOLDER**—By which a cake of soap can be securely held, and manipulated, as in washing, without bringing the hands in actual contact with the soap. Patent 1675022. V. F. Creegan, c/o Postal Telegraph Co., Albuquerque, N. M.

**DOLL OR THE LIKE**—Having a coupling means which enables the torso, arms, and legs to be pressed into coupling engagement, yet permitting free movement of the arms and legs. Patent 1676096. A. Kwasnicki, 1350 Willoughby Ave., Brooklyn, N. Y.

**SORTING DESK**—Including a receptacle for large stacks of mail or newspapers, and means for securely holding each shelf and allowing for the adjustment of various sized pigeonholes. Patent 1675454. S. A. Harrison, 1379 W. 22nd St., Los Angeles, Calif.

**PAPER RECEPTACLE**—For example, a milk bottle constructed from a single blank of folded material, the contents introduced thereto through the bottom, sealed, and subsequently removed through the top. Patent 1677040. C. H. McGiehan, c/o Mrs. C. H. McGiehan, Nyack, N. Y.

**ANTIMARRING MEANS FOR PICTURE FRAMES**—Having means associated with the usual cord or wire holding screw eyes, for preventing marring of the wall, should the picture frame move. Patent 1675771. S. Sterling, Biltmore Hotel, Los Angeles, Calif.

**HOSE PROTECTOR**—In which a plurality of sections formed of metal are pivotally connected together, and conform to the configurations of the hose when in use. Patent 1677077. D. D. Fortune, c/o G. W. Fernstrom, 718 18th St., N. W., Apt. 52, Washington, D. C.

**PROTECTIVE APPARATUS**—For the protection of banks, treasures, or stores, when a hold-up is attempted, whereby mechanism is actuated at a distance from the door, closing the same. Patent 1675428. E. J. Schiffko, 689 24th St., Oakland, Calif.

**SAFETY-DEPOSIT RECEPTACLE**—By means of which, when traveling in a public conveyance such as a boat or train, one is able to protect ones valuables against theft. Patent 1676707. E. S. Peer, P.O. Box 77, Central Station, Portland, Oregon.

**TWINE HOLDER**—Wherin the shaft is arranged to facilitate the application or removal of the cord, and a detachable cutter blade is provided on the support. Patent 1677799. R. Salvaggio, 1330 Magazine St., New Orleans, La.

**COTTON-TIE SPlicer**—For cotton bales, which will present no sharp edges and will have a maximum of strength, designed to conform to the requirements of the law. Patent 1677828. P. L. Howlett, Brownwood, Texas.

**ATTACHMENT FOR WRITING IMPLEMENTS**—Which includes finger receiving devices which insure the proper gripping of the implement, and facilitate the teaching of penmanship. Patent 1678578. J. M. Utrilla, Santa Domingo 7, Guanabacoa, Havana, Cuba.

**SELF-TEACHING DEVICE**—In the nature of a holder in which a number of members bearing interrogatory indicia may be removably associated with members bearing answers, written by child. Patent 1678621. W. H. Holmes, 60 South 3rd Ave., Mt. Vernon, N. Y.

**FOOD TRAY**—By means of which various foods constituting a meal, and the necessary forks, spoons, etc., can be transported without fear of the foods intermixing. Patent 1677276. L. A. Deicken, 1156 Gordon St., Los Angeles, Calif.

**SEAT BACK**—Constructed with an adjustable clamping means for giving particular angles, may be attached to a boat seat, or board seat in a field stand. Patent 1679238. H. A. Boies, c/o A. R. Sturtevant, Middlebury, Vt.

**FIRE EXTINGUISHER**—For oil storage tanks, adapted to serve as a temporary cap, for a burning tank, and to discharge steam for effectively smothering the fire. Patent 1679243. D. Fasul, 1739 Pilgrim Ave., Bronx, N. Y.

**WINDOW CONSTRUCTION**—Of substantially conventional appearance, but in which the sashes are mounted to swing inwardly to facilitate the cleaning of outside or inside surfaces without danger. Patent 1679278. J. Suter, 12 Park Ave., Guttenberg, N. J.

**METHOD AND APPARATUS FOR PLACING POLES**—Comprising a concrete base embedded in the ground, a supporting socket for holding the bottom of the pole with an air space slightly above the base support. Patent 1679297. A. Ehler, c/o E. Stahlnecker, 28-50 37th St., Astoria, L. I., N. Y.

**ATTACHMENT FOR OPHTHALMIC MOUNTINGS**—In the form of detachable supplemental lenses for defusing glaring rays of light, so that the vision will not be effected. Patent 1679233. L. Straus, 317 E. 34th St., New York, N. Y.

**SEPARABLE FASTENER**—By which two elements can be connected with facility and dispatch against accidental disconnection, adapted for such fastenings as curtain brackets, garments, vehicle curtains, etc. Patent 1678166. T. Repay, 1619 ½ W. 22nd St., Los Angeles, Calif.

**MILK-COOLING DEVICE**—Whereby a number of fine streams of cold water are directed to the neck of the can, and a water film permitted to flow down over the surface. Patent 1679302. H. J. Foster, Stowe, Vt.

**POLE**—Stamped from a single piece of sheet metal, will resist the strain of a fence or telegraph lines, may be used as a base for old or rotted poles. Patent 1680172. C. E. Pine, 10 So. Cheger St., Oklahoma City, Okla.

**BUILDING CONSTRUCTION**—A concrete flooring which is light construction yet has great relative strength, and in which the ceiling is level, with no projecting beams. Patent 1679672. S. Klein, 64 East Lake St., Chicago, Ill.

**POWDER BOX**—Including a container having an inner tray with sifter openings and a puff of sufficient size to fill the tray and prevent spilling of the powder. Patent 1680150. C. S. Humphrey, c/o The Manhattan Can Co., 882 3rd Ave., Brooklyn, N. Y.

**RECORD FILE**—Comprising a series of pockets for receiving records or account sheets, each overlapping the other stepwise, so that the sheets themselves constitute an index. Patent 1680177. A. Schwarz, c/o G. Papponheim, Schulerstrasse, Vienna, Austria.

**TOILET CASE**—For holding the necessary articles for toilet in an accessible manner, may be used as a wall fixture or carried as a traveling accessory. Patent 1680196. E. C. Austin, Warrensburg, N. Y.

**RADIO LOG AND PROGRAM DEVICE**—Comprising a case in which a record of stations, wave lengths, etc., may be conveniently kept on one strip, and the daily broadcasting program on another. Patent 1680164. T. W. Montrose, 186 Bower St., Jersey City, N. J.

**HOSE COUPLER**—Particularly adapted for garden hose, readily applicable to the meeting ends of sections for hermetically sealing the same, may be quickly detached when necessary. Patent 1679709. C. G. Cooper, 740 First Ave., Yuma, Arizona.

### Hardware and Tools

**HINGE**—Constructed from a minimum number of parts, and capable of supporting a maximum of weight with a minimum defacement of the door. Patent 1675262. E. Flagg, 111 East 40th St., New York, N. Y.

**PIPE TONGS**—For use in screwing and unscrewing pipe sections, couplings and tool joints of rotary drill pipes, applicable to pipes of widely varying diameters. Patent 1675748. F. S. Bunker, c/o J. W. Hughes, R. I., Box 280, Long Beach, Calif.

**LOCKING COUPLING**—Adapted for rapidly attaching the end of a pipe to a fitting without the necessity for threading either the pipe end or the fitting. Patent 1676585. T. B. Tiefenbacher, 830 Sheridan Ave., No. Elizabeth, N. J.

**UNDERREAMER**—Which will rapidly enlarge the hole below the well, with a minimum amount of wear on the tool, and little danger of losing the cutters. Patent 1677812. C. H. Brown, c/o Brown Tool Co., Breckenridge, Texas.

**SAFETY SNAP HOOK**—Which may be easily applied to, or disconnected from a hoisting tub, and will withstand the hard usage of mine operations. Patent 1677814. O. R. and R. N. Close, c/o Roy N. Close, Carterville, Mo.

**YIELDABLE SUPPORT**—A metal column, adapted to take the place of supporting timbers which is yieldable under excessive pressure without distorting the main body. Patent 1677796. R. D. Parks, 119 Jasper St., Houghton, Mich.

**CUSHIONING HANDLE FOR PNEUMATIC TOOLS**—Including a number of springs interposed between the barrel and the casing in such manner as to take up and absorb shocks and jars. Patent 1679201. S. Byers, 411 North "M" St., Bedford, Ind.

**PIPE CUTTER**—Wherein the various cutters are caused to travel in the same plane, and one or more used and guided to move in the path intended. Patent 1679321. R. F. McKay, 193 Joralemon St., Brooklyn, N. Y.

**ROTARY DRILL BIT**—For boring oil wells and the like, allowing a circulation of water during the drilling action, and a separate passage for the rising water carrying the mud. Patent 1678201. J. P. Samuelson, Box 622, Banning, Calif.

#### Heating and Lighting

**RADIATOR VALVE**—For automatically permitting the exhaust of air from steam radiators, by means of an air vent thermostatically actuated by the steam entering the valve. Patent 1673648. A. S. Svenson, 99 Curie, Clifton, N. J.

**BOILER DUST DOOR**—A construction which facilitates the expeditious repair of the brick work immediately adjacent the door in case failure occurs, and renders the door more durable. Patent 1674492. R. Will, 42-35 South 162 St., Flushing, L. I., N. Y.

**HEATER FOR HAIR-WAVING OUTFITS**—Capable of fitting over coiled hair without any adjustment of the parts, may be quickly applied or removed, and will almost surround the hair being treated. Patent 1674591. G. Decker, Yale Bldg., 216 High Ave., Cleveland, Ohio.

**BOILER CONSTRUCTION**—With an outer wall structure to define a heat chamber in which the gases of combustion will circulate to create a greater heat. Patent 1675194. M. O'Donnell, c/o Mrs. E. O'Donnell, 3718 Ruddie St., Long Island City, N. Y.

**DAMPER**—Which normally gravitates to closed position, is applicable to vertical flues of different inclinations, and can be adjusted prior to application to a particular flue. Patent 1674202. W. Hallberg, 10580 Ayres Ave., Los Angeles, Calif.

**AIR CIRCULATOR FOR STOVES**—An attachment for the type known as "parlor stoves," will cause the stove to throw off a maximum amount of heat, from a minimum consumption of fuel. Patent 1679307. W. G. Hutchison, 1610 Mound St., Portsmouth, Ohio.

**OIL BURNER**—Wherein the burner plate can be quickly pre-heated before the oil is turned on, and carbon on the surface of the burner is reduced to a minimum. Patent 1680193. V. Aiello, 28 Battle Ave., White Plains, N. Y.

**STEAM GENERATOR**—Or water heater, adapted for burning oil or gas, permitting ready cleaning operations, especially the removal of soot from the heat passages. Patent 1680166. L. N. Moss and J. S. Weston, c/o Louis N. Moss, P.O. Box 965, Cedarhurst, N. Y.

#### Machines and Mechanical Devices

**GRADER**—For road or street grading, including a mold board, and a reversible double-edged blade-bit which can be used a relatively long time. Patent 1674110. T. H. Harden, Dawson, Ga.

**MEANS FOR LUBRICATING RAPIDLY REVOLVING SPINDLES**—In which the oil is thrown from a chamber, through one channel, to the spindle bearing, and returns through another channel. Patent 1674605. F. Mortensen, Maskin-och Broleyggna Aktiebolaget, Helsingfors, Finland.

**BOX-CUTTING MACHINE**—Adapted for forming paper boxes, which will not only shear the card board transversely, but will slot the ends to form flaps. Patent 1675247. W. W. Brust, c/o Sun Lumber Co., Wiston, W. Va.

**CAR-DUMPING APPARATUS**—Whereby the contents of a car may be dumped and the car returned to starting position, the entire mechanism being operated by a single person. Patent 1675197. W. F. Schadet, c/o Kanawha Mfg. Co., 1520 Dixie St., Charleston, W. Va.

**PISTON RE-SIZER**—Easily operated to re-size a piston of the split skirt type, and to assure accuracy of size within a considerable range of expansion. Patent 1675238. W. C. Walker, c/o Aby & Tucker, 1st Nat. Bank Bldg., Tulsa, Oklahoma.

**MOLDING MACHINE**—Which may be quickly set for forming dough into rolls, or loaves, of practically any shape or length required in commercial baking. Patent 1674229. F. A. Scruggs, 1536 Ewing St., Los Angeles, Calif.

**DRILLING MACHINE**—A safety slip ring arrangement especially designed for use with rotary drills for preventing objects falling into the well while drilling or removing the pipe. Patent 1676129. H. C. Brewster, c/o Oil City Iron Works, Shreveport, La.

**PUMP**—Particularly adapted for oil wells, operated by a flexible cable without requiring the use of extra tubing pump rods, additional casing, etc., quickly lowered or removed. Patent 1675390. C. Starzky, Marysville, Texas.

**SPINNING AND TWISTING MACHINE**—Which permits a speed change without any variations of the length of the chain gear, by having the chain transmitting members adjustably supported. Patent 1676093. J. J. Keyser, c/o G. Hirschfeld, Alexandrinenstrasse 134, Berlin S. W., Germany.

**PACKING FOR OIL WELLS**—Which may be readily placed in position, and by a simple operation expanded, and locked into place, the packing being readily removed without breakage. Patent 1676168. C. Starzky, Marysville, Texas.

**PROPELLING AND STEERING MEANS FOR POWER SPEED BOATS**—Which will offer a minimum of resistance, and includes a pair of laterally spaced rear rudder blades, and forward side deflector blades, coupled for movement in unison. Patent 1676158. W. J. Roe, 256 Liberty St., Newburgh, N. Y.

**SURFACING MACHINE**—For effecting burnt surface decoration upon lengths of material, such as wood, and for obtaining a wide range of variation with the same peripheral pattern. Patent 1676111. E. H. Reiber, West Webster, N. Y.

**DISPENSING DEVICE**—Adapted to dispense cigarettes or like articles, and ejecting the same from the device one at a time. Patent 1676109. E. Oldenbusch, 366 Butler St., Brooklyn, N. Y.

**AIR-TRAPPING DEVICE FOR LUBRICATING CUPS**—Which will function to limit the amount of oil during the filling, and insure sufficient air to render the oil, when heated, responsive for proper lubrication. Patent 1675036. W. B. Lynch, c/o Arcadia Lubricator Co., 1355 West Ocean Ave., Long Beach, Calif.

**ICE-CAN BRACKET AND DROP TUBE**—Which will serve to firmly retain an ice can against the

bottom of a freezing tank, so that in freezing the block will be square topped. Patent 1676089. W. W. Johnson, 400 Linden Ave., Memphis, Tenn.

**PHONOGRAPH**—Having a turntable and tone arm mechanism of such construction that it may be applied to an ordinary machine to enable the playing of much longer records. Patent 1676101. C. K. Lyons and A. H. Dunn, 36 Grimm Place, Baldwin, L. I., N. Y.

**TESTING MACHINE**—For testing pipe fittings for minute blow holes, cracks, and flaws in the walls, which would render the fittings unsuitable for use under pressure. Patent 1675802. F. A. Hamilton, c/o Southern Calif. Gas Co., Los Angeles, Calif.

**SAFETY DEVICE FOR ELEVATORS AND THE LIKE**—Which will give warning of a stretch in the hoist cable, and in the event of a brake, will grip the guide rails, and stop the elevator. Patent 1676443. J. Kaspe, c/o H. Carminier, Bayrenther St. 26, Berlin W. 30, Germany.

**FLUID PUMP**—Which may be associated with an oil string casing to permit its withdrawal without disturbing the casing, and will prevent solid particles from entering the working area. Patent 1675434. C. Van Amburgh, 333 Dayman St., Long Beach, Calif.

**LIQUID-VENDING APPARATUS**—Adapted for dispensing gasoline, oil, or other liquid from a container, the liquid being releasable by the insertion of appropriate coin into a coin slot. Patent 1677113. N. W. Clayton, 1077 First Ave., Salt Lake City, Utah.

**ALARM CLOCK**—The mechanical construction of the working parts being made with such precision as to permit of ready replacement and repairs prolonging the period of usefulness. Patent 1677790. W. F. McKinley, 105 W. 2nd St., Little Rock, Ark.

**WELL PUMP**—In which a plurality of chain carried pistons are utilized to draw the water from the well upwardly through a suction tube to a discharge point. Patent 1677802. J. F. Struble, 225 East "B" St., Hutchinson, Kans.

**APPARATUS FOR EXTINGUISHING FIRE**—Whereby the exhaust gases of a combustion engine are employed for blowing a fire extinguishing powdery substance to the place of fire. Patent 1677875. C. Szilvay, c/o F. Schorn VII Erzsebet-Korut 19, Budapest, Hungary.

**PRESSURE-CONTROL DEVICE FOR USE IN COUPLING OIL-WELL CASING**—Whereby the joints between several sections of casing may be completed uniformly at the desired pressure, the device being constructed to endure rough usage. Patent 1677538. E. G. Whaley, 213 So. 9th St., Enid, Okla.

**METHOD AND MEANS FOR PRODUCING EARTH-ENWARE PIPES AND PRODUCTS RESULTING THEREFROM**—Whereby pipe and other clay products are made to possess structural integrity and homogeneous, and a strength to be expected of uniform texture throughout, with closeness of grain and homogeneity. Patent 1677808. F. J. T. S. and F. Alassio, c/o Uruguay Consul, 17 Battery Place, New York, N. Y.

**MACHINE FOR DRILLING AND COUNTERSINKING BRAKE LININGS**—By means of which a new lining may be formed, with countersunk rivet holes in alignment with the holes in the brake band, by one operation only. Patent 1678207. R. Brandt, 1625 Pacific Ave., San Francisco, Calif.

**THREAD CLEANER**—For silk threads, wherein means are provided for accurately spacing the parts for a proper sizing of the threads as they pass through the cleaner. Patent 1679258. E. C. Neu, c/o Schwarzenbach & Huber Co., 23rd St. and Bergeline Ave., Union City, N. J.

**PROCESS AND MEANS FOR EXTRACTING PETROLEUM**—By which the extraction of oil is greatly expedited by pressure transmitting conduits, and is not dissipated radially as from bore holes. Patent 1679683. J. L. Rich, Box 3, Ottawa, Kansas.

**COTTON GIN**—For removing fibers from cotton seeds by an air blower, the seeds being separately discharged free of cotton, without interfering with the removal of the lint. Patent 1680132. C. S. Cox, 1248, "R" St., Fresno, Calif.

### Medical Devices

**BODY BRACE**—Which may be securely applied to the body, and adjusted on the wearer by shoulder and leg straps, constraining the wearer to assume an erect position. Patent 1675854. E. Branson, 319 North 3rd St., Livingston, Mont.

**POCKET SPUTUM CUP**—Constructed from a single sheet of material, with a closure flap formed to positively seal the cup against the escapement of the contents. Patent 1680151. J. Kauffman.

### Musical Devices

**UPRIGHT PIANO**—In which is incorporated sound amplifying horns, under the ends of the keyboard, so that better quality and greater volume of tone, will be emitted. Patent 1679290. V. Bessier, 677 McDonough St., Brooklyn, N. Y.

**BANJO STAND**—A collapsible stand on which a banjo may be placed with safety during intermissions, may be accommodated in an ordinary banjo case. Patent 1673205. A. Romao, c/o Musical Accessories Corp., Oakland, Calif.

**OUNDING BOARD FOR PIANOS**—For improving the tone, by attaching to the usual wooden ribs of the sound board, struts having flat faces, for increasing the resonant effect. Patent 1680180. W. H. M. Siegel, c/o F. Schwenterly Koniggratzerstr 59, Berlin S. W. 11, Germany.

### Plumbing and Fittings

**URINAL**—Which may be swung out from under a wash basin, and kept absolutely sanitary by film of running water covering the walls of the urinal while in use. Patent 1675263. E. Flagg, 111 E. 40th St., New York, N. Y.

**PLUMBING FIXTURE**—In the form of a mixing chamber for hot and cold water connections, for use with sink fixtures, capable of a wide range of adjustment. Patent 1679276. H. W. Slinning, c/o Recpal Brass Mfg. Co., 2115 E. 27th St., Los Angeles, Calif.

### Prime Movers and Their Accessories

**INTERNAL COMBUSTION ENGINE**—In which each cylinder has a single port and means for automatically connecting the single port of each cylinder successively with the intake and exhaust. Patent 1665421. G. H. Roos, 1228 N. Court St., Carroll, La.

**SLEEVE OF THE ENGINE OF SLEEVE-VALVE TYPE**—Which is protected from the alternate flexion and lateral reactions which are caused by the lateral control of the sleeve. Patent 1677051. C. Schaeffer, c/o C. Bletry, 2 Boulevard de Strasbourg, Paris, France.

**VACUUM TANK**—For actuating the suction and air valves through the medium of a float, constructed to permit of its direct association with a conventional form of carburetor. Patent 1676767. E. G. Burns, 2763 Fruitdale Ave., Los Angeles, Calif.

**TRANSMISSION GEARING**—In which the moving parts are enclosed in a substantially dust-proof accessible casing, adaptable for many uses where exposed gears would be subject to clogging. Patent 1679264. R. C. Parker, 415 John St., La Porte, Ind.

**PISTON**—Which may be constructed of light weight material, such as aluminum, or its equivalent, adapted for use with internal combustion motors. Patent 1678768. L. R. Davis, 278 Avila St., San Francisco, Calif.

### Railways and Their Accessories

**GRAIN-CAR-DOOR-OPENING MEANS**—Which functions in conjunction with a pivotally mounted door, to apply a sufficient force to move the door against the heavy pressure exerted thereon. Patent 1674577. J. Towers, Fargo, No. Dak.

**RAILWAY CROSSING**—Which will positively prevent persons from unknowingly driving upon a track in a straight path, by being compelled to detour, stop, and turn at an angle. Patent 1674498. J. D. Bundy, De Kalb, Texas.

### Pertaining to Recreation

**GAME APPARATUS**—Including a plurality of playing pieces simulating miniature locomotives and cars, the board surface containing tracks, and switch members adapted to predetermine the movement of the locomotives. Patent 1673705. M. E. Pesnel, 63 Tiffany Place, Brooklyn, N. Y.

**SWING**—Adapted to be actuated by bodily movements, cannot be accidentally overturned, and may be constructed almost entirely of lengths of pipe and pipe fittings. Patent 1674517. A. B. Newson, 1918 So. 3 East, Salt Lake City, Utah.

**GAME BOARD**—For the game of checkers, the surface being arranged with a greater number of squares, and an increase of playing pieces, with the possibilities of more intricacies. Patent 1674533. S. W. Templeton, 120 So. Butler Ave., Indianapolis, Ind.

**TOY**—Adapted to simulate various types of automotive vehicles, which may be easily steered and trundled along by a child without any great manual effort. Patent 1676085. L. E. Gerrish, 13 Whipple St., Kittery, Maine.

**TOY CONSTRUCTION OUTFIT**—Which comprises structural elements made of wood, in the form of rods, plates, blocks and disks, adapted to be assembled to produce a plurality of objects. Patent 1678602. G. G. Oldfield, 1104 Kamiak St., Pullman, Wash.

**AMUSEMENT DEVICE**—A playing table having a plurality of recesses into which a ball may be rolled, and in which when the ball is lodged the score is signaled. Patent 1678573. Y. Nakashima, Boardwalk 21st-22nd St., Coney Island, N. Y.

**TOY PISTOL**—Having means for insuring precision in feeding the cap strip and for preventing the product of explosion, when a cap is fired, from injuring the user. Patent 1678597. J. D. Kilgore, 127 14th Ave., Columbus, Ohio.

**GAME APPARATUS**—Comprising a board over which balls are manually projected toward a target, which when struck disappears from view allowing the ball to return for successive operations. Patent 1678189. L. S. McVey, Rulo, Neb.

**SWIMMING GLOVE**—Constructed with webs between the fingers which when spread cause the hand to act on larger bodies of water, resulting in greater speed. Patent 1679679. S. E. Neill, 2026 16th St., Bakersfield, Calif.

**AMUSEMENT DEVICE**—Including a plurality of targets, and a compartment corresponding to each target containing articles constituting prizes, which are automatically dispensed when the target is hit. Patent 1680167. I. Noda, Cor. Bowery & 15th St., Coney Island, N. Y.

### Pertaining to Vehicles

**SUPPLY MEANS FOR LUBRICANT-DISTRIBUTING SYSTEMS**—By which the lubricant in the bottom of the crank case may be utilized for lubricating the whole vehicle with all its bearings. Patent 1671421. C. C. Goodrich, 639 Turk St., San Francisco, Calif.

**RECOIL OR SNUBBING MECHANISM**—Which can be easily applied to vehicles and will hold the body to a slow and easy upward movement, after a sudden downward pressure. Patent 1673230. C. M. Cronkhite, 1345 Graynold Ave., Glendale, Calif.

**BUMPER**—An inflated cushioning attachment, which will fit flat against the bumper to prevent injury, may be connected without skilled labor. Patent 1673692. C. F. Marston, 100 Chester Ave., Brooklyn, N. Y.

**STOP-SIGNAL SWITCH FOR MOTOR VEHICLES**—For use in indicating from the back of a vehicle, may be automatically manipulated, or used in combination with a direction indicator, and independently actuated. Patent 1673206. E. E. Safely, 410-42 St., Oakland, Calif.

**DIRECTION INDICATOR**—For indicating changes in direction of travel, either "left" or "right" turns, and "stop," in response to the operation of steering gear, or brake mechanism. Patent 1675215. J. F. Greene, 5920 162 St., Flushing Heights, L. I., N. Y.

**TRACTOR TRAILER**—Having coupling means by which the greater part of the trailer load will be supported by the tractor, and the tractor can turn at relatively sharp angles. Patent 1675267. P. E. Hanson, 1801 Strand, Galveston, Tex.

**GASOLINE-DISPENSING SYSTEM**—A device by which any one of a plurality of vending stands may be operated for dispensing gasoline independently of the other stands. Patent 1675231. H. F. Stoke, Roanoke, Va.

**SIGNALING DEVICE FOR AUTOMOBILES**—Adapted to display a "slow" signal when the clutch is in low gear, and a "stop" signal when the brake and clutch pedals are depressed. Patent 1675203. C. L. White, 3915 Labadio Ave., St. Louis, Mo.

**PRESSURE-INDICATING DEVICE**—For indicating to a driver, while the vehicle is in motion, the pressure within a tire, a lamp being actuated by under or over inflation. Patent 1675410. J. H. Gartner, 150 Sequoia Drive, San Anselmo, Calif.

**LAND AND WATER VEHICLE**—Which may be used as an automobile on land, or as a boat in the water, without making any alterations, or without the operator leaving his seat. Patent 1677846. G. E. Powell, 2347 Claybourne Ave., Chicago, Ill.

**AUTOMOBILE HEATER**—Wherein the heat radiating tubes are disposed in the bottom of the car and are fed through an adjacent valve from the exhaust pipe, without leakage. Patent 1678567. H. L. Hubbard, 13823 Fernwood St., E. Cleveland, Ohio.

**DIRECTION SIGNAL**—Capable of being associated with, and manually actuated by the rotation of the conventional steering mechanism of a vehicle, to indicate "Left" or "Right" turns. Patent 1678197. D. W. Pratt, 1904 11th St., Santa Monica, Calif.

**ANTIGLARE SHIELD AND METHOD OF MAKING THE SAME**—Which in light of average intensity, or at night, allows objects to appear in their natural colors, but in strong light, or sunshine, becomes colored and diminishes glare. Patent 1678218. R. M. Gruss, 458 Fell St., San Francisco, Calif.

**SPEED-WARNING DEVICE**—Which may be attached to a radiator cap and normally hid from view, but is raised by air pressure to warn the driver of dangerous speed. Patent 1679320. J. Matthews, Box F, Absecon, N. J.

**AXLE GAUGE**—Particularly adapted for use in gauging the alignment of axles on automobiles equipped with four-wheel brakes. Patent 1678761. R. P. Bernhardt and V. D. Black, Jr., c/o Coast Mfg. & Supply Co., Box 227, Livermore, Calif.

**DEVICE FOR PREVENTING RETROGRADE MOVEMENT**—Which will automatically lock the running gear of an automobile to prevent backward movement when the car has been stopped on an inclined roadbed. Patent 1680148. J. L. Gonard, Cayteville, N. J.



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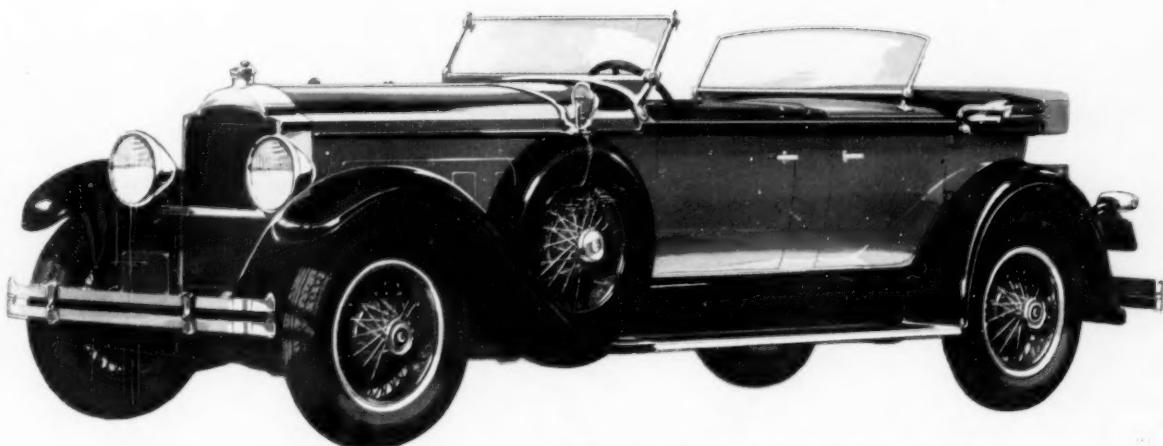
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